

1997

Revised

EV¹™

HVAC

Service Manual

CAUTION

To reduce the chance of personal injury and/or property damage, the following instructions must be carefully observed.

Proper service and repair are important to the safety of the service technician and the safe, reliable operation of all motor vehicles. If part replacement is necessary, the part must be replaced with one of the same part number or with an equivalent part. Do not use a replacement part of lesser quality.

The service procedures recommended and described in this service manual are effective methods of performing service and repair. Some of these procedures require the use of tools specifically designed for the purpose.

Accordingly, anyone who intends to use a replacement part, service procedure, or tool that is not recommended by the vehicle manufacturer must first determine that neither his safety nor the safe operation of the vehicle will be jeopardized by the replacement part, service procedure, or tool selected.

It is important to note that this manual contains various "Cautions" and "Notices" that must be carefully observed in order to reduce the risk of personal injury during service or repair or the possibility that improper service or repair may damage the vehicle or render it unsafe. It is also important to understand that these "Cautions" and "Notices" are not exhaustive; it is impossible to warn of all the possible hazardous consequences that might result from failure to follow these instructions.

This vehicle has a high voltage power system. Disabling the system is required when working on or around the high voltage system and high voltage battery pack (other than testing the system using the procedures in this manual).

To help avoid severe shocks and burns and vehicle damage, always follow the cautions in this manual to disable the high voltage system. See the high voltage disable and enable procedure in the front of this service manual.

This vehicle is equipped with Supplemental Inflatable Restraint (SIR). Refer to "CAUTIONS" under "On-Vehicle Service" and the SIR Component and Wiring Location views in the "SIR Service Manual" before performing service on or around SIR components or wiring. Failure to follow "CAUTIONS" could result in possible air bag deployment, personal injury, otherwise unneeded SIR system repairs.

To help avoid accidental air bag deployment and personal injury, when servicing a vehicle that requires repair of the SIR system and another vehicle system, it is recommended that the SIR be repaired first using service manual procedures.

CAUTION

Saturn Service Manuals are intended for use by professional, qualified technicians. Attempting repairs or service without the appropriate training, tools, and equipment could cause injury to you or others and damage to your vehicle that may cause it not to operate.



HVAC

CAUTION

To ensure the safety of personnel injury and/or property damage, the following instructions must be carefully observed:

Always service and repair only important to the safety of the vehicle. The repair must be replaced with one of the same type, number or specification. Do not use a replacement part of lower quality.

The service procedures recommended and described in this service manual are effective methods of performing service and repair. Some of these procedures require the use of tools specific to the design of the vehicle.

Always use the correct type of tools. Do not use a replacement part, service procedure or tool that is not recommended. The use of a replacement part, service procedure or tool that is not recommended may void the warranty. The use of a replacement part, service procedure or tool that is not recommended may void the warranty.

It is important to note that the manual contains information on "Caution" and "Warning" labels. These labels are placed in the manual to alert the technician of potential hazards. The "Caution" label is used to alert the technician of potential hazards that could result in property damage or personal injury. The "Warning" label is used to alert the technician of potential hazards that could result in death or serious injury.

This manual is a high voltage manual. It contains information on the high voltage system of the vehicle. The high voltage system is a system that is used to power the vehicle's air conditioning system. The high voltage system is a system that is used to power the vehicle's air conditioning system.

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All information, illustrations and specifications contained in this guide are based on the latest product information that was available at the time of publication. Saturn reserves the right to make changes at anytime without notice.

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Table of Contents

HVAC

NOTICE

Always use the correct fastener in the proper location. When you replace a fastener, use **ONLY** the exact part number for that application.

The applicable service procedure will identify, where necessary, those fasteners that must be replaced after removal; or those fasteners that require thread lockers or thread sealant.

UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener.

When you install fasteners, use the correct tightening sequence and specifications.

Following these instructions can help you avoid damage to parts and systems.

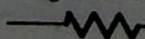
GLOSSARY OF ACRONYMS	11
HIGH VOLTAGE DISABLE	16
Removal	16
HIGH VOLTAGE ENABLE	17
Installation	17
12 VOLT SYSTEM DISABLE	18
12 VOLT SYSTEM ENABLE	18
SIR SYSTEM	19
ON VEHICLE SERVICE	19
Service Precautions	19
Disabling the SIR System	19
Enabling the SIR System	20
HVAC INTRODUCTION	21
Diagnostic Flow Chart	21
Preliminary Checks	21
Complaint—Condition Tables	21
Vehicle Set Up/Performance Test	21
General and Specific System Condition Charts	21
Performance Test at 45 Mph (72 KmH)	21
Fastener Usage	22



HVAC

Table of Contents

Fastener Strength Identification	23
Prevailing Torque Fasteners	24
English-Metric Conversions	25
Decimal and Metric Equivalents	27
LIFTING, JACKING, AND SUPPORT POINTS	28
GENERAL INFORMATION	29
Hoisting/Lifting for a 2 Post Above Ground Hoist - (Side Car)	30
Hoisting/Lifting for a 2 Post Inground Hoist - (Front and Rear)	32
Hoisting/Lifting with a Floor Jack.	33
Underbody Front Air Deflector	36
Removal	36
Installation	37
Power Electronics Bay (PEB)	39
Removal	39
Installation	43
HEAT PUMP VENTILATION SYSTEM INTRODUCTION	48
Climate Control System	48
Cooling Mode	48
Heating Mode	48
HEAT PUMP VENTILATION SYSTEM	49
Heat Pump Ventilation Thermal Control System	49
“Cool Mode” for Ambient Temperatures Greater than 66°F) (Heat Pump Active)	49
System Operation	49
“Heat Mode” for Ambient Temperatures Greater than 19°C (66°F) (Heat Pump Inactive)	50
System Operation	50
“Heat Mode” for Ambient Temperatures Equal to or Less than 19°C (66°F) (Heat Pump Active)	51
System Operation	51
“Vent Mode” for All Temperature Ranges (Heat Pump Active)	52
System Operation	52
“DeFex Cycle” When in “HEAT MODE” (Heat Pump Active)	53
System Operation	53
EV1 CABIN HEATING / COOLING POWER OPERATION MATRIX	54
SERVICE	55
Diagnostic Flow Chart	55



POWER DISTRIBUTION	56
System Operation	56
Run1/Run2 Circuit Operation	56
Vehicle "Wake-UP Command" and "Run 1/wake-up" During Charging	56
Periodic Wake-Up	56
HTCM SCAN TOOL INFORMATION	57
PRELIMINARY CHECKS	59
Test 1 – Heat Pump Compressor Insulation/Megger Test	60
Test 2 – Heat Pump Compressor Electrical Test	63
Vehicle Set-Up	68
Performance Test – With PDT or Service Stall	68
Installing Manifold Gauge Set	69
SYSTEM CONDITION CHARTS DEFINITION AND USAGE	71
NORMAL SYSTEM PERFORMANCE SERVICE STALL	71
NORMAL SYSTEM PERFORMANCE HIGH HUMIDITY	72
GENERAL SYSTEM CONDITION - LOW REFRIGERANT CHARGE	73
GENERAL SYSTEM CONDITION - LOW SIDE RESTRICTIONS	74
GENERAL SYSTEM CONDITION - HIGH SIDE RESTRICTIONS	75
CLIMATE CONTROLS LOCATION VIEWS	76
HTCM GENERAL DESCRIPTION	78
Temperature Sensor:	78
Pressure Transducer:	78
Coolant Pump/Coolant Pump Buffer:	78
Front End Fan/Front End Fan Buffer:	78
ACCESSORY AC AND DC POWER MODULE (APM)	79
Auxiliary Battery Power	79
Heated Windshield (HWS) Control	80
Compressor Control	80
APM Status Messages and Load Shed Command	81
12 Volt Status Lines	81
HWS and Compressor Status Lines	81
Load Shed Command	82
APM Wakeup/Run	82



GENERAL DESCRIPTION	83
Water Pump Assembly	83
Chart 1 – Coolant Pump Stays On	84
Chart 2 – Cooling Fan Inoperative	85
Chart 3 – Cooling Fan Stays On	86
DTC 10 – High Side Pressure Transducer Open/Short	88
DTC 11 – Low Side Pressure Transducer Open/Short	92
DTC 12 – Drive Motor Coolant Temperature Sensor (DMTS) Short to Ground	94
DTC 13 – Refrigerant Temperature Sensor (RTS) Short to Ground	96
DTC 14 – Pump Coolant Temperature Sensor (PCTS) Short to Ground	98
DTC 15 – Discharge Temperature Sensor (DTS) Short to Ground	100
DTC 16 – Outside Temperature Sensor (OTS) Short to Ground	102
DTC 17 – Coolant Level Switch (CLS) Failure	104
DTC 18 – Outside Air Valve Actuator (v) Feedback Open/Short	108
DTC 19 – Outside Air Valve Actuator (OAV) Feedback Out Of Range	110
DTC 20 – Outside Air Valve Actuator (OAV) Not Responding	112
DTC 21 – Windshield On Command Output Failure	114
DTC 22 – Mode Valve Actuator Feedback Open/Short	116
DTC 23 – Mode Valve Actuator Feedback Out of Range	118
DTC 24 – Mode Valve Actuator Not Responding	120
DTC 25 – Compressor Motor Case Voltage High	122
DTC 26 – Preconditioning Aborted	124
DTC 27 – Accessory Power Module (APM) Shutdown	126
DTC 28 – Heated Windshield Fault	128
DTC 29 – Compressor Motor Control (CMC) Isolated Gate Bi-Polar Transistor (IGBT) Fault #1	130
DTC 30 – Compressor Motor Control (CMC) Overcurrent Fault #2	132
DTC 31 – Compressor Motor Control (CMC) Input Voltage Out of Range ...	134
DTC 32 – Compressor Motor Control (CMC) Overtemp or Interlock Fault ...	136
DTC 33 – Compressor Motor Control (CMC) Pulse Width Modulated (PWM) Signal Out of Range	138
DTC 34 – Run/Lock Shift Assembly (RSA) Serial Data Lost While in Run Mode	140
DTC 36 – Battery Pack Control Module (BPM) Serial Data Lost	142
DTC 37 – Accessory Power Module (APM) 12 Volt Out of Range Major	144
DTC 38 – Accessory Power Module (APM) Low Auxiliary Battery	146
DTC 39 – Accessory Power Module (APM) 12 Volt Out of Range Minor	148

DTC 40 – Electro-Hydraulic Power Steering (EHPS) Pump Motor Case Voltage High	150
DTC 41 – Accessory Power Module (APM) 47 Volt Isolation	152
DTC 42 – Accessory Power Module (APM) 47 Volt Out of Range	154
DTC 43 – Automatic Disconnect Open	156
DTC 44 – Pack Voltage Fault	158
DTC 45 – HTCM Memory Failure	160
DTC 46 – Accessory Power Module (APM) Over Temperature	162
DTC 47 – Coolant Over Temperature	164
DTC 48 – Drive Motor Over Temperature	166
DTC 49 – Power Inverter Module Over Temperature	168
DTC 50 – Coolant Pump Failure	170
DTC 51 – Coolant Temperature Heat Pump Override	172
DTC 52 – Low Side Pressure Threshold Exceeded	174
DTC 53 – High Side Pressure Threshold Exceeded	176
DTC 54 – Low Coolant Level	178
DTC 58 – Coolant Recovery Check Valve (CRV) Feedback Short	180
DTC 59 – Coolant Recovery Check Valve (CRV) Feedback Out of Range	182
DTC 60 – Coolant Recovery Check Valve (CRV) Not Responding	184
DTC 61 – 47V/Compressor Motor Control (CMC) Status Line 2 Fault	186
DTC 62 – Charger Receptacle Coolant Valve (CRCV) Feedback Short	188
DTC 63 – Charger Receptacle Coolant Valve (CRCV) Feedback Out of Range	190
DTC 64 – Charger Receptacle Coolant Recovery Valve (CRCV) Not Responding	192
DTC 65 – Brake Loadshed Occurred	194
COOLING FAN SCHEMATIC	196
CLIMATE CONTROL SCHEMATICS	197
HARNESS CONNECTOR FACES	206
Accessory A/C and D/C Power Module (APM)	249
Removal	249
Installation	249



LEAK TESTING	250
Liquid Leak Detectors	250
Electronic Leak Testers	251
Handling R-134A	252
Maintaining Chemical Stability in the Refrigeration System	252
Adding Oil	252
Oil Distribution	252
Refrigerant Oil Loss Due to a Large Leak	252
Recovering, Evacuating, and Charging the Heat Pump System	253
HEAT PUMP SYSTEM R-134A RECOVERY	254
Evacuating the System	254
Charging the Heat Pump System	255
Handling Refrigerant Lines and Fittings	256
O-Rings	257
Service Gauge Port Valves	258
Valve Core	258
Removal	258
Installation	258
A/C Accumulator Tube Assembly	258
Reversing Valve to Accumulator	258
Removal	258
Installation	260
A/C Evaporator Tube Assembly	262
Orifice to Evaporator	262
Removal	262
Installation	262
A/C Condenser Tube Assembly	264
Reversing Valve to Condenser	264
Removal	264
Installation	265
A/C Condenser Tube Assembly	267
Reversing Valve to Evaporator	267
Removal	267
Installation	268
A/C Refrigerant Orifice Tube Assembly	270
Condenser to Orifice Tube	270
Removal	270
Installation	271
Compressor Suction Tube Assembly	273

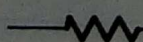


Accumulator to Compressor	273
Removal	273
Installation	274
Refrigerant Reversing Valve Tube Assembly (Discharge Tube)	277
Reversing Valve to Compressor	277
Removal	277
Installation	278
Compressor Information	280
Compressor	280
Removal	280
Compressor Oil Measurement	283
Judgement on Contamination of Compressor Oil	284
New Compressor Installed Oil Charge	284
Compressor	285
Installation	285
General Description	288
Compressor Mounting Bracket	289
Removal	289
Installation	289
Outside Air Temperature Sensor Assembly	289
Removal	289
Installation	289
Heat Pump Ventilation System/Thermal Control Module (HTCM)	290
Removal	290
Installation	290
Condenser Radiator Fan Module Assembly (CRFM)	291
Removal	291
Installation	296
General Description	301
Heater and A/C Refrigerant Reversing Valve Assembly	302
Removal	302
Installation	303
General Description	305



Table of Contents

A/C Accumulator Assembly	307
Removal	307
Installation	308
General Description	310
Accumulator Bracket	311
Removal	311
Installation	311
Blower Motor Assembly	312
Removal	312
Installation	312
General Description	313
Mode Valve Actuator Assembly	314
Removal	314
Installation	314
General Description	315
Outside Air Valve Actuator Assembly	316
Removal	316
Installation	316
General Description	317
Blower Motor Control Module Assembly	318
Removal	318
Installation	318
General Description	319
Heat Pump Ventilation Module Discharge Temperature Sensor Assembly	320
Removal	320
Installation	328
Heater and A/C Evaporator and Blower Module	337
Removal	337
Installation	349
General Description	360
INDEX	361
EV1 SERVICE MANUAL COMMENT FORM	365



GLOSSARY OF ACRONYMS

Acronym	Definition
ABS	Anti-Lock Braking System
AM	Amplitude Modulation
Amp	Ampere
APM	Accessory AC and DC Power Control Module. With PIM, makes up PEB
APS	Auxiliary Power Supply (part of APM)
BCA	Bias Control. Assembly
BPM	Battery Pack Module
BRS	Battery Reserve Switch
BTCM	Brake/Torque Control Module
BTSI	Brake Transmission Shift Interlock (GM)
CD	Compact Disc
cfm	Cubic Feet per Minute
cg	Center of Gravity
CHMSL	Center High-Mount Stop Lamp
CMC	Compressor Motor Controller (part of APM)
CPA	Connector -- Positive Assurance
CR	Charge Receptacle
CRFM	Condenser Radiator Fan Module (part of HPVS)
CTPS	Check Tire Pressure System
DC	Direct Current
DLC	Data Link Connector
DERM	Diagnostic and Energy Reserve Module (SIR control module)
DIA	Dealer Installed Accessory
DM	Drive Motor
DRL	Daytime Running Light
E/M	English/Metric
ECM	Engine Control Module (used with internal combustion engines)
EHPS	Electro-Hydraulic Power Steering
EKP	External Keypad
EMB	Electro-Magnetic Brake (part of ABS)
EMI	Electromagnetic Interference
EPS	Electric Power Steering. Also see EHPS



GLOSSARY OF ACRONYMS CONTINUED

Acronym	Definition
ETS	Electronic Traction System
EV	Electric Vehicle
EVO	Electronic Variable Orifice Control (in power steering pump)
FLIP harness	Forward Lamp – Instrument Panel Harness. Name of major EV low voltage wire
FM	Frequency Modulation
FOD	Front of Dash
g	Gram
GFI	Ground Fault Interrupt
GVMR	Gross Vehicle Mass Rating
GVW	Gross Vehicle Weight
HPVM	Heat Pump Ventilation Module
HPVS	Heat Pump Ventilation System. Similar to HVAC on ICE vehicles
HTCM	HPVS/Thermal Control Module
HV	High Voltage
HVAC	Heating, Ventilating, and Air Conditioning (on ICE vehicles. For EV, see HPVS).
HWS	Heated Windshield
HWS	Hand Wheel Sensor
Hz	Hertz (cycles per second)
I/O	Input(s)/Output(s)
IC	Integrated Circuits
IGBT	Isolate Gate Bipolar Transistor
IP	Instrument Panel
ISRV	Inside Rear View (mirror)
JB	Junction Block
KAM	Keep Alive Memory
kg	Kilogram
km	Kilometer
km/h	Kilometers per hour

GLOSSARY OF ACRONYMS CONTINUED

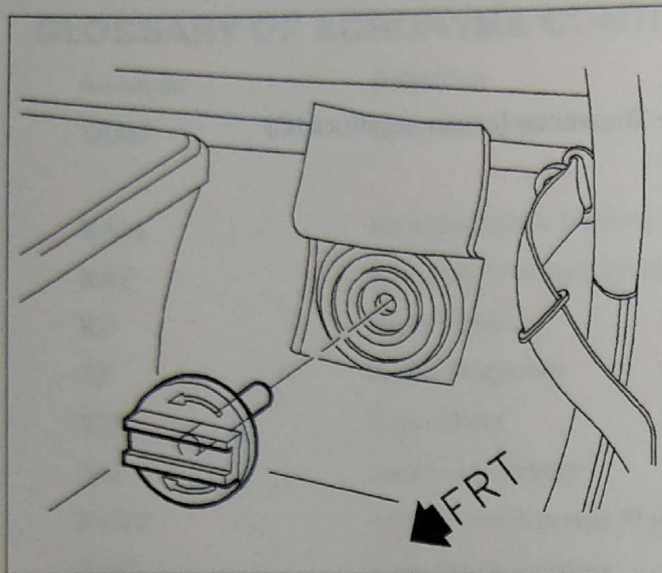
Acronym	Definition
kPa	Kilo Pascals
kW	Kilowatt
kWh	Kilowatt-hour
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LF	Left Front
LH	Left Hand
LHD	Left Hand Drive
LHJB	Left Hand Junction Block
LR	Left Rear
LVW	Loaded Vehicle Weight
m	Meter
MMC	Metal Matrix Composite (Rear Brake Drum Material)
MHz	Megahertz
mi	Mile(s)
MPH	Miles Per Hour
MSRP	Manufacturers Suggested Retail Price (includes dealer preparation)
MUX	Multiplex or Multiplexer
N	Newton(s)
NTF	No Trouble Found. Reported failure does not reoccur under test
OEM	Original Equipment Manufacturer
OSRV	Outside Rear View (mirror)
PCM	Propulsion Control Module (Drive Motor)
PDT	Portable Diagnostic Tool
PEB	Power Electronics Bay
PIM	Power Inverter Module
POA	Part of Assembly
PRND	Park-Reverse-Neutral-Drive, as in PRND Selector
PROM	Programmable Read Only Memory
PSOC	Pack State of Charge
PTC	Positive Thermal Coefficient. Term for resistive heating module
PWM	Pulse Width Modulation, or Pulse Width Modulated

GLOSSARY OF ACRONYMS CONTINUED

Acronym	Definition
QDM	Quad Driver Module
RAM	Random Access Memory
RAP	Retained Accessory Power
RF	Right Front
RF	Radio Frequency
RH	Right Hand
RH	Relative Humidity
RHJB	Right Hand Junction Block
RMS	Root-Mean-Squared
ROM	Read Only Memory
RP	Reduced Performance
RPM	Revolutions Per Minute
RR	Right Rear
RSA	Run/Lock Shifter Assembly
SAE	Society of Automotive Engineers
SDL	Serial Data Link
SDM	Sensor Diagnostic Module
SIR	Supplemental Inflatable Restraint (air bag) system
SLA	Short-Long Control Arm (suspension system)
SOC	State of Charge (battery pack). Usually expressed as a percentage
SN	Service Now
SSPO	Saturn Service Parts Operation
SS	Service Soon
SWA	Steering Wheel Angle
TNF	Trouble – Not Found. Reported failure reoccurs but cause cannot be determined
TJB	Trunk Junction Block
TOD	Time of Day
TPA	Terminal – Positive Assurance
T/S	Turn Signal
TT	Telltale

GLOSSARY OF ACRONYMS CONTINUED

Acronym	Definition
UART	Universal Asynchronous Receiver – Transmitter (communications IC)
UH	Under Hood
ULEV	Ultra-Low Emissions Vehicle
USOL	User State of Charge
V5B	5 Volt Supply
VAC	Voltage, Alternating Current
VF	Vacuum Fluorescence
VH	Vehicle Handling
VIN	Vehicle Identification Number
VTD	Vehicle Theft Deterrent
W	Watt
WSS	Wheel Speed Sensor (part of ABS)
WSW	Windshield Washer/Wiper
ZEV	Zero Emission Vehicle



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HIGH VOLTAGE DISABLE

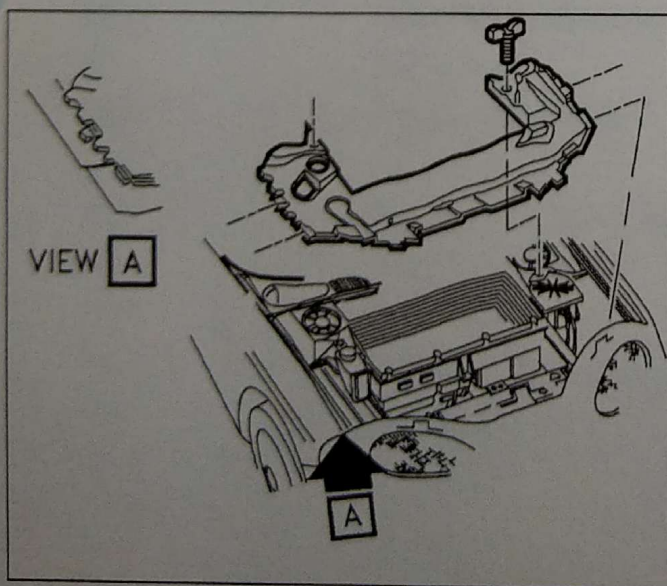
REMOVAL

CAUTION: TO REDUCE THE RISK OF SEVERE SHOCKS AND BURNS, THE HIGH VOLTAGE SYSTEM SHOULD BE DISABLED ANY TIME SERVICE WORK IS BEING PERFORMED ON OR AROUND THE HIGH VOLTAGE SYSTEM. WHEN IN DOUBT, ALWAYS DISABLE THE HIGH VOLTAGE SYSTEM. THE 12 VOLT SYSTEM WILL STILL BE ACTIVE AFTER THE HIGH VOLTAGE SYSTEM HAS BEEN DISABLED.

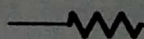
1. Place the vehicle in the "RUN" mode.
2. Remove the manual disconnect knob.
 - a. Tilt the drivers seat forward.
 - b. Raise the carpet flap, located on the battery tunnel behind the drivers seat.
 - c. Turn the manual disconnect knob counterclockwise and pull the manual disconnect knob straight out.

IMPORTANT: An audible click should be heard when turning the manual disconnect knob. This click indicates the automatic disconnect relays have opened.

3. Verify high voltage has been removed.
 - a. Connect scan tool to the data link connector (DLC) and run the High Voltage special test. Battery pack module (BPM) diagnostic trouble codes (DTCs) 312, 280 and/or 275 should be present, which indicates BPM and auto disconnect recognized a high voltage disconnect.
 - b. If test fails, refer to service manual "High Voltage Special Test Failed" in the "Battery and Charging System Service Manual."
4. Remove engine compartment sight shield.

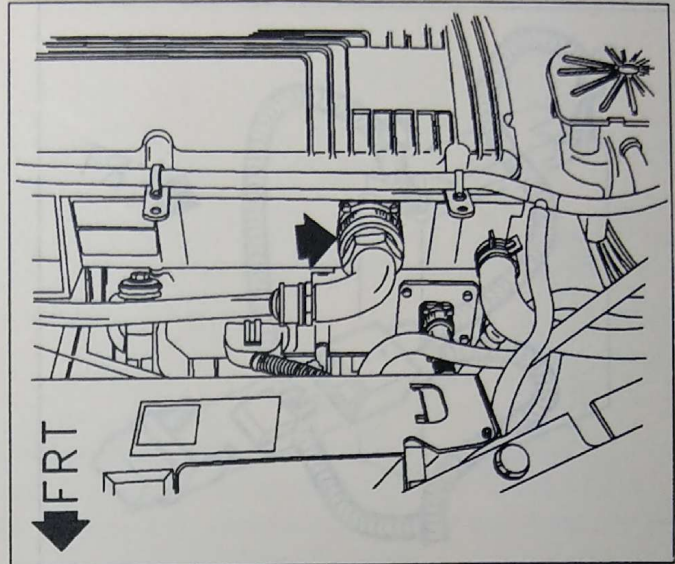


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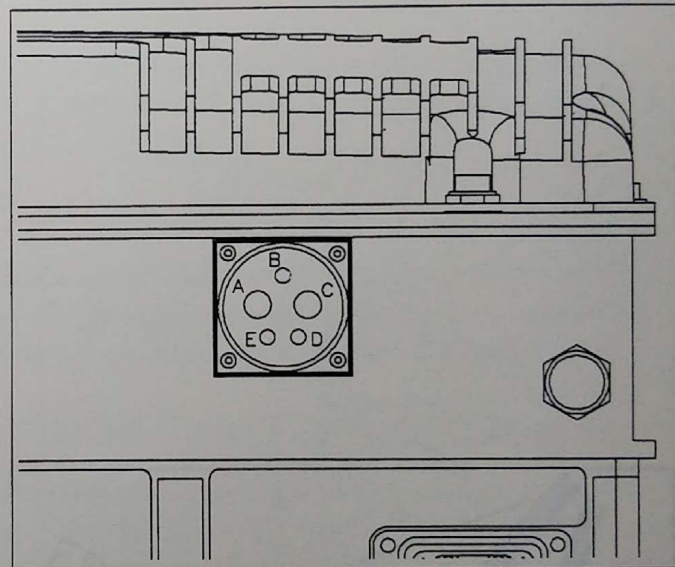
CAUTION: TO REDUCE THE RISK OF SEVERE SHOCKS AND BURNS, ALWAYS ASSUME THE HIGH VOLTAGE IS PRESENT WHEN DISCONNECTING THE CHARGE RECEPTACLE TO PIM CONNECTOR. DO NOT ALLOW THE CONNECTOR BODY TO TOUCH THE PINS OF THE PIM WHEN REMOVING THE CONNECTOR.

5. Remove the charge receptacle to power inverter module (PIM) cannon connector using one hand.



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6. Using a DVOM and only one hand, measure from pin A of the PIM to chassis ground and from pin C of the PIM to chassis ground and from pin A to C. All measurements should be less than 10 volts. Pin C and Pin A are the large high voltage pins on the PIM.
 - a. If the voltage is less than 10 volts, high voltage system is disabled.
 - b. If the voltage is greater than 10 volts, refer to the "High Voltage" section in the "Battery and Charging Service Manual."

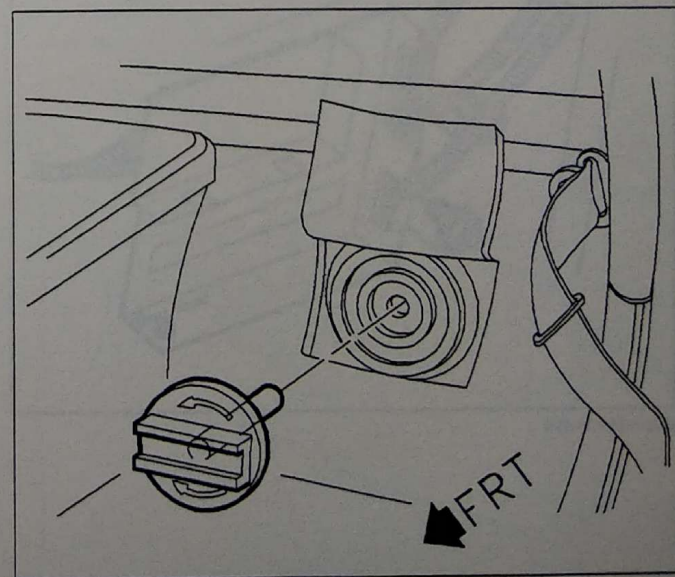


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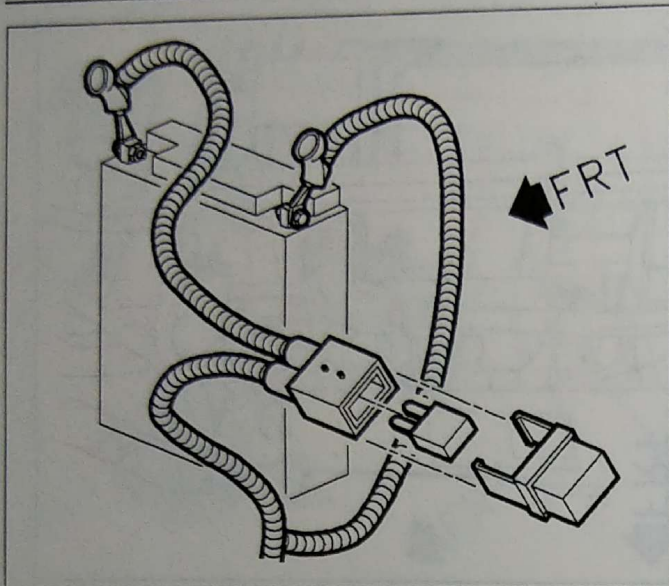
HIGH VOLTAGE ENABLE

INSTALLATION

1. Install charge receptacle to PIM cannon connector.
2. Install engine compartment sight shield.
3. Tilt driver's seat forward.
4. Raise the carpet flap, located on the battery tunnel behind the driver's seat.
5. Install the manual disconnect knob by pushing the shaft straight into the hole and turning clockwise.
6. Clear all DTCs using the scan tool.



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12 VOLT SYSTEM DISABLE

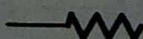
CAUTION: DISABLE THE 12 VOLT ELECTRICAL SYSTEM TO HELP AVOID PERSONAL INJURY OR POSSIBLE DAMAGE.

IMPORTANT: The key pad must be in the LOCK mode for two minutes prior to performing the following step. Failure to do so could result in the loss of memory that retains the battery pack state of charge. If this occurs refer to "Battery Pack and Charging System" service manual for details.

1. Remove the cover on the 60 amp maxi fuse holder located in the negative auxiliary battery cable.
2. Remove the 60 amp maxi fuse.

12 VOLT SYSTEM ENABLE

1. Install 60 amp maxi fuse located on the negative auxiliary battery cable
2. Place cover on maxi fuse holder.



SIR SYSTEM

ON VEHICLE SERVICE

SERVICE PRECAUTIONS

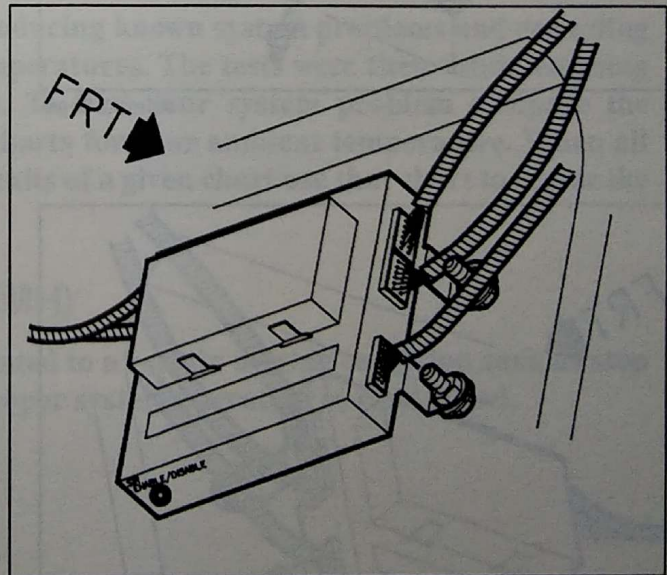
CAUTION: WHEN PERFORMING SERVICE ON OR AROUND SIR COMPONENTS OR SIR WIRING FOLLOW THE PROCEDURE BELOW TO TEMPORARILY DISABLE THE SIR SYSTEM. FAILURE TO FOLLOW PROCEDURES COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY OR OTHERWISE UNNEEDED SIR SYSTEM REPAIRS.

THE SENSING AND DIAGNOSTIC MODULE (SDM) CAN MAINTAIN SUFFICIENT VOLTAGE TO CAUSE A DEPLOYMENT FOR UP TO 10 MINUTES AFTER THE KEY PAD HAS BEEN PLACED IN THE "LOCK" MODE, ALSO IF THE AUXILIARY BATTERY IS DISCONNECTED OR THE SIR "ENABLE/DISABLE" SWITCH IS PLACED IN THE DISABLE POSITION. MANY OF THE SERVICE PROCEDURES REQUIRE THE SIR "ENABLE/DISABLE" SWITCH TO BE PLACED IN THE "DISABLE" POSITION AND DISCONNECTION OF THE DEPLOYMENT LOOPS TO AVOID AN ACCIDENTAL DEPLOYMENT.

DISABLING THE SIR SYSTEM

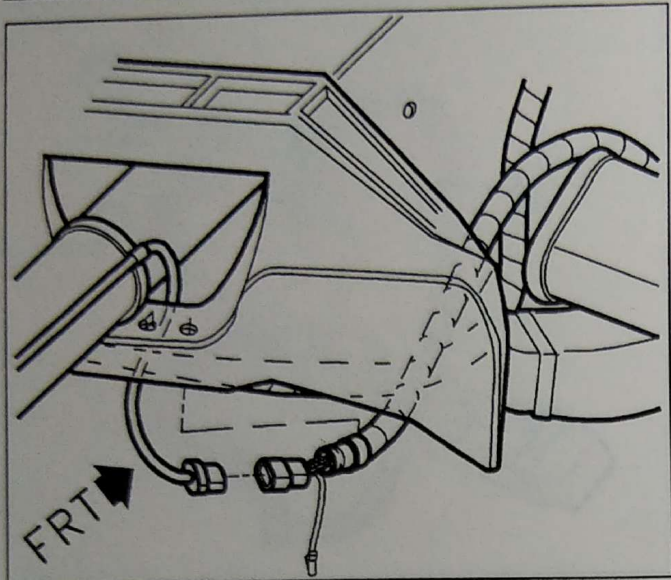
1. Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
2. Place the key pad in the **LOCK** mode.
3. Place the SIR "ENABLE/DISABLE" switch in the right hand junction block in the **DISABLE** position.

IMPORTANT: With the SIR ENABLE/DISABLE switch in the **DISABLE** position and the key pad in the **RUN** mode, the AIR BAG telltale lamp will be "On." This is normal operation and does not indicate an SIR system malfunction.

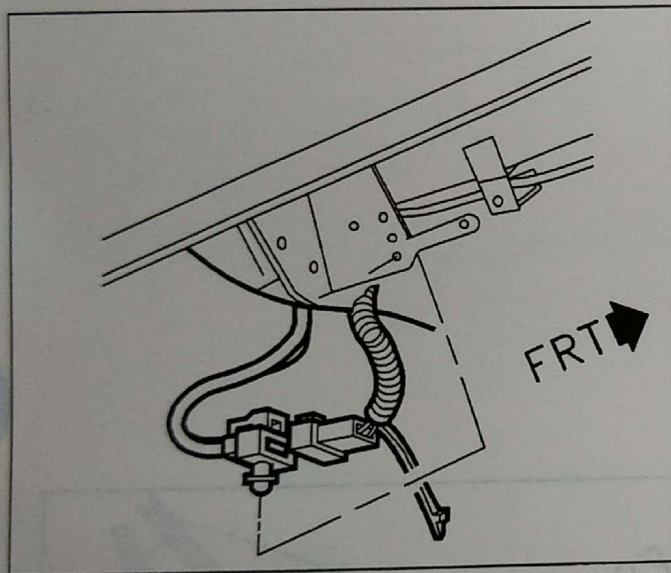


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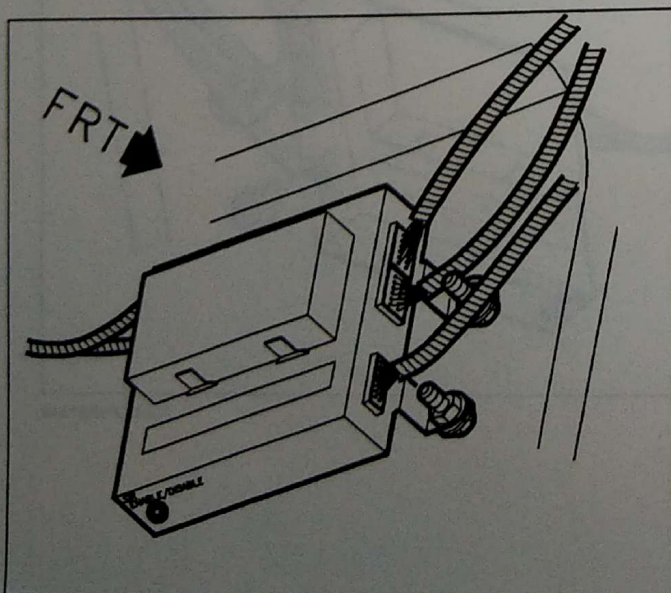




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4. Remove connector position assurance (CPA) device and disconnect yellow two-way connector located near the base of the steering column.

5. Remove connector position assurance (CPA) device and disconnect yellow two-way connector located on passenger inflator module pigtail under RH side of I/P.

ENABLING THE SIR SYSTEM

1. Place key pad in the **LOCK** mode.
2. Connect yellow two-way SIR connector at the base of steering column and install connector position assurance (CPA) device to connector.
3. Connect yellow two-way passenger inflator module pigtail and install connector position assurance (CPA) to connector.
4. Place **SIR ENABLE/DISABLE** switch to the **ENABLE** position, located in the RH junction block.
5. Place key pad in the "RUN" mode and verify that the AIR BAG telltale lamp flashes seven times as the key pad is placed in the "RUN" mode and then goes Off. If lamp does not operate as described above perform the "SIR Diagnostic System Check" in this manual.

HVAC INTRODUCTION

DIAGNOSTIC FLOW CHART

This chart is the starting point for verifying and diagnosing all air conditioning and HVAC control related complaints. It represents the correct path to follow from a customer complaint or condition through delivery of the vehicle.

PRELIMINARY CHECKS

This step covers all physical and visual inspections of interior and underhood components. Most problems can be detected by a thorough inspection. Failure to perform this step could result in wasted time and/or misdiagnosis. All preliminary checks must pass before proceeding further down the flow chart.

COMPLAINT-CONDITION TABLES

These tables will direct you to the appropriate service manual section based on conditions found during the preliminary checks. All information necessary to repair or replace a component is included in that components section.

VEHICLE SET UP/PERFORMANCE TEST

To run an air conditioning performance test the vehicle must be set-up according to the service manual instructions. The instructions include manifold gauge set installation and controller settings. Improper vehicle set up will result in inaccurate pressure and temperature readings.

GENERAL AND SPECIFIC SYSTEM CONDITION CHARTS

These charts were developed in a wind tunnel by producing known system problems and recording pressures and temperatures at various ambient temperatures. The tests were then validated using the same vehicle setup in a service environment. To find your system problem compare the performance test readings to the readings on the charts for your ambient temperature. When all pressure and temperature readings fall within the limits of a given chart use that chart to repair the vehicle.

PERFORMANCE TEST AT 45 MPH (72 KMH)

Perform this test when a customers complaint is related to a certain driving condition such as stop and go traffic on a hot sunny day. This will verify proper system operation at road speed.

FASTENER USAGE

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger), with the same protective coating may be used. Fasteners that cannot be reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require them. If the above conditions are not followed, parts or system damage could result.

Many fasteners are metric. Metric fasteners may be close in dimension to well-known English fasteners in the inch system. Replacement fasteners must be the correct nominal diameter, thread pitch and strength.

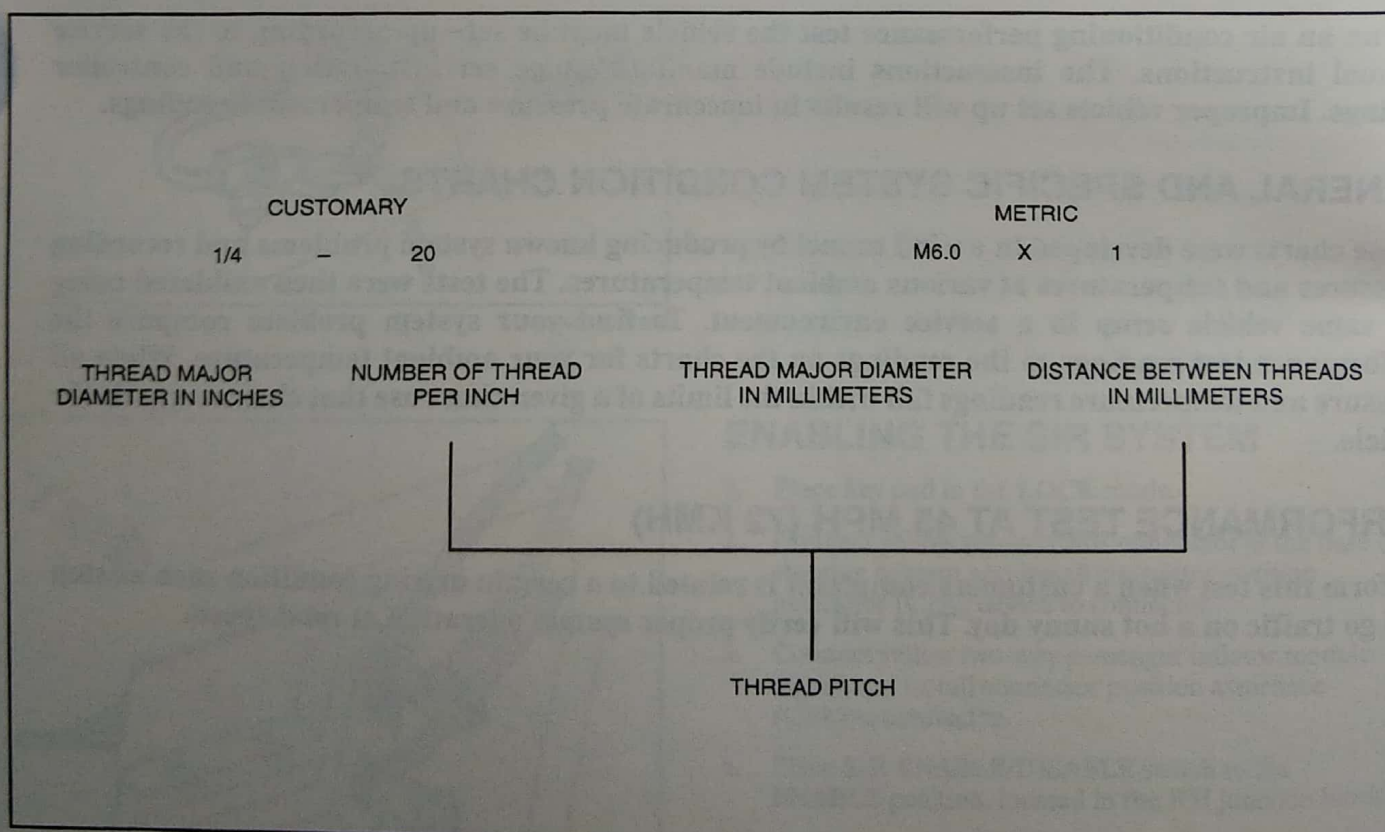
Original equipment metric fasteners, except for exposed bumper bolts and other beauty bolts and cross-recess head screws, have numbers on their heads that can be identified by a Posidriv or a Type 1A cross-recess. Either type of cross-recess screwdriver can be used to remove Posidriv recess head screws, but Type 1A will perform better.

NOTICE: Most metric fasteners have a blue color coating. This coating should not be used to positively identify fasteners because not all metric fasteners are color-coated. Damage to the fastener or part could result if a English fastener is incorrectly used to replace a metric fastener.

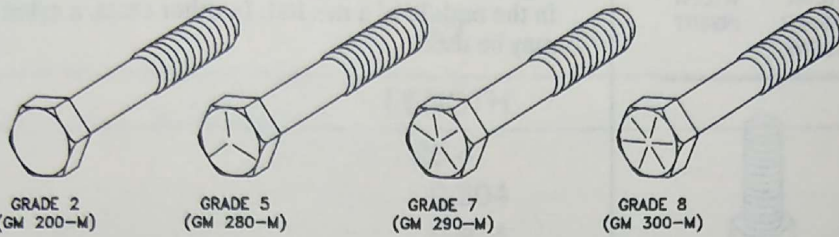
Metric and English thread notations differ slightly. For example, the thread major diameter of a 1/4-20 bolt/screw is 1/4 inch, and the bolt/screw has 20 threads per inch. The thread major diameter of an M6.0x1 bolt/screw is 6.0 mm, and the bolt/screw has a 1 mm between threads.

Many aluminum components are used on present GM models. Aluminum in contact with steel may corrode rapidly if not protected by special finishes or isolators. There are three special finishes which meet GM specifications; they are GM 6111-M (gray), GM 6047 (black) or GM 6147-M (black). These special fasteners differ in color from the standard metric fasteners, which are medium blue, in order to make them easily identifiable.

NOTICE: When replacing fasteners avoid substituting otherwise similar fasteners in locations which require the use of GM 6111-M, GM 6047, or GM 6147-M type special fasteners for aluminum components. Failure to follow this precaution may result in premature corrosion of sheet metal or fastener.

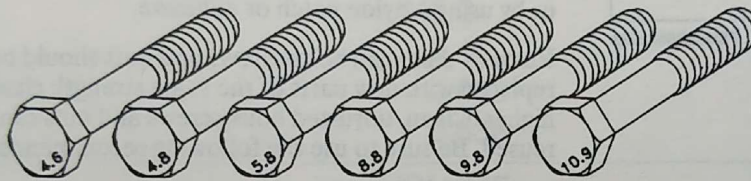
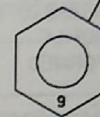


FASTENER STRENGTH IDENTIFICATION



ENGLISH (INCH) BOLTS/SCREWS - IDENTIFICATION MARKS CORRESPOND TO BOLT/SCREW STRENGTH - INCREASING NUMBERS REPRESENT INCREASING STRENGTH.

NUT STRENGTH IDENTIFICATION



METRIC (INCH) BOLTS/SCREWS - IDENTIFICATION CLASS NUMBERS CORRESPOND TO BOLT/SCREW STRENGTH - INCREASING NUMBERS REPRESENT INCREASING STRENGTH.

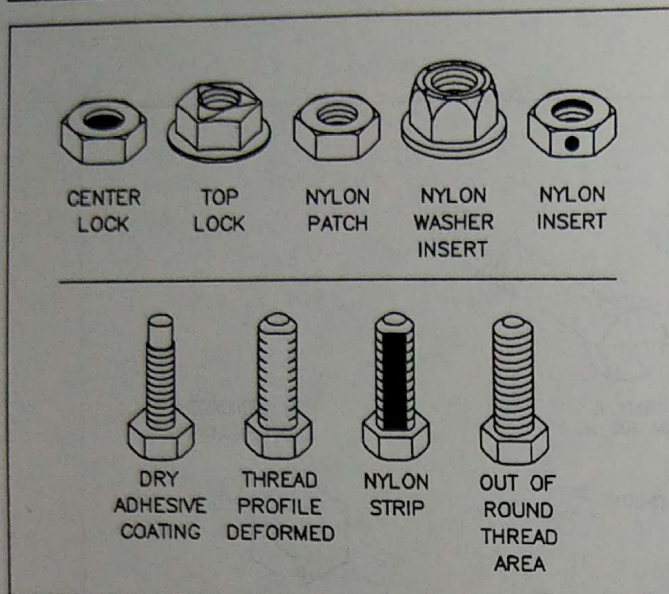
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Most commonly used metric fastener strength property classes are 9.8 and 10.9. The class identification is embossed on the head of each bolt/screw. English fastener strength property classes range from grade 2 to 8. Radial lines are embossed on the head of each bolt/screw to identify the strength class. Some metric nuts are marked with strength identification numbers on the nut face.

When replacing fasteners, be careful to use bolts/screws and nuts of a strength class equal to, or higher than, the original fasteners (the same number marking or higher).

Also select replacement fasteners of the correct size. Correct replacement bolts/screws and nuts are available through Saturn Service Parts Operation (SSPO).

Many metric fasteners available in the aftermarket parts channels were designed to metric standards of countries other than the United States. The fasteners may have different strength or thread pitch and may not have the numbered head marking system. The metric fasteners used on GM products are designed to new international standards that might not be used by some nondomestic bolt/screw and nut suppliers.



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PREVAILING TORQUE FASTENERS

A prevailing torque nut is designed to develop a interference between the nut and bolt/screw threads. This interference is usually created by distortion of the top of an all-metal nut or by a nylon patch in the threads in the middle of a hex flat. In other cases, a nylon insert may be used.

A prevailing torque bolt/screw is designed to develop an interference between the bolt/screw and nut threads or between the bolt/screw and tapped hole threads. This interference is created by distorting some of the threads or by using a nylon patch or adhesive.

Rusty or damaged bolts/screws and nuts should be replaced with new parts of the same strength class or higher. Clean, unruled bolts/screws and nuts can be reused. Be sure to use the following recommendations:

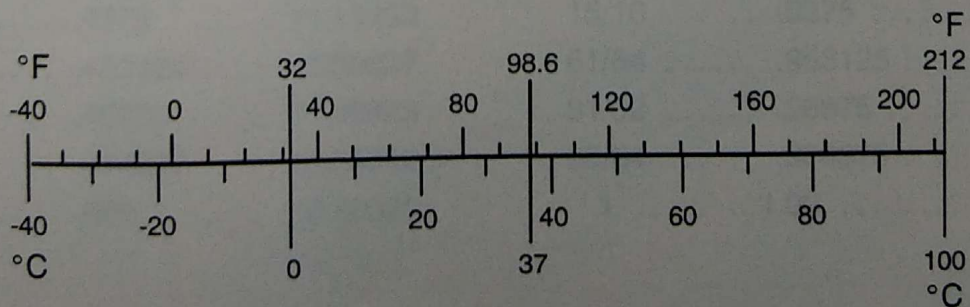
1. Clean dirt and other foreign material from nut or bolt/screw.
2. Inspect nut of bolt/screw for cracks, elongation or other signs of abuse or overtightening. If nut or bolt/screw is worn in any way, replace with a nut or bolt/screw of the same strength class or higher.
3. Assemble the parts and hand-start nut or bolt-screw.
4. Check that nut or bolt/screw fails to develop the proper torque before it seats. If nut or bolt/screw fails to develop torque correctly, replace with a nut or bolt/screw of the same strength class or higher.
5. Tighten fastener to the torque specified in the appropriate installation procedure in this manual.

FASTENER TYPE	TORQUE UNITS	METRIC-SIZE FASTENERS							
		6	6.3	8	10	12	14	16	20
NUTS AND ALL METAL BOLTS/SCREWS	N•m	0.4	0.4	0.8	1.4	2.2	3.0	4.2	7.0
	Lb. In.	4	4	7	12	19	27	37	62
ADHESIVE OR NYLON COATED BOLTS/SCREWS	N•m	0.4	0.4	0.6	1.2	1.6	2.4	3.4	5.6
	Lb. In.	4	4	5	11	14	21	30	50
FASTENER TYPE	TORQUE UNITS	INCH-SIZE FASTENERS							
		.250	.312	.375	.437	.500	.562	.625	.750
NUTS AND ALL METAL BOLTS/SCREWS	N•m	0.4	0.6	1.4	1.8	2.4	3.2	4.2	6.2
	Lb. In.	4	5	12	16	21	28	37	55
ADHESIVE OR NYLON COATED BOLTS/SCREWS	N•m	0.4	0.6	1.0	1.4	1.8	2.6	3.4	5.2
	Lb. In.	4	5	9	12	16	23	30	49

ENGLISH-METRIC CONVERSIONS

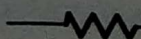
To convert English units to Metric units, multiply the English units by the conversion factor shown. To convert Metric units to English units, divide the Metric units by the conversion factor shown.

Multiply	by	to get equivalent number of:
LENGTH		
Inch	25.4	millimeters (mm)
Foot	0.304	meters (m)
Yard	0.914	meters
Mile	1.609	kilometers (km)
AREA		
Inch ²	645.2	millimeters ² (mm ²)
	6.45	centimeters ² (cm ²)
Foot ²	0.092	meters ² (m ²)
Yard ²	0.836	meters ²
VOLUME		
Inch ³	16 387.0	mm ³
	16.387	cm ³
	0.016	liters (l)
Quart	0.946	liters
Gallon	3.785	liters
Yard ³	0.764	meters ³ (m ³)
MASS		
Pound	0.453	kilograms (kg)
Ton	907.18	kilograms (kg)
Ton	0.907	tonne (t)
FORCE		
Kilogram	9.807	newtons (N)
Ounce	0.278	newtons
Pound	4.448	newtons
TEMPERATURE		
Degree Fahrenheit (°F)	(°F-32) ÷ 1.8	Degree Celsius (C)



ENGLISH-METRIC CONVERSIONS (CONTINUED)

Multiply	by	to get equivalent number of:
ACCELERATION		
Foot/sec ²	0.305	meter/sec ² (m/s ²)
Inch/sec ²	0.025	meter/sec ²
TORQUE		
Pound-inch	0.113	newton-meters (N•m)
Pound-foot	1.356	newton-meters
POWER		
Horsepower	0.746	kilowatts (kW)
PRESSURE OR STRESS		
Inches of water	0.248	kilopascals (kPa)
Pounds/sq. in.	6.895	kilopascals
ENERGY OR WORK		
BTU	1 055.	joules (J)
Foot-pound	1.356	joules
Kilowatt-hour	3 600 000. or 3.6×10^6	joules (1 joule = one watt-second)
LIGHT		
Foot candle	10.76	lumens/meter ² (lm/m ²)
FUEL PERFORMANCE		
Miles/gal	0.425	kilometers/liter (km/l)
Gal/mile	2.353	liter/kilometer (l/km)
VELOCITY		
Miles/hour	1.609	kilometers/hr. (km/h)



DECIMAL AND METRIC EQUIVALENTS

Fractions	Decimal In	Metric MM	Fractions	Decimal In	Metric MM
1/64	.015625	.39688	33/64	.51625	13.09687
1/32	.03125	.79375	17/32	.53125	13.49375
3/64	.046875	1.19062	35/64	.546875	13.89062
1/16	.0625	1.58750	9/16	.5625	14.28750
5/64	.078125	1.98437	37/64	.578125	14.68437
3/32	.09375	2.38125	19/32	.59375	15.08125
7/64	.109375	2.77812	39/64	.609375	15.47812
1/8	.125	3.17500	5/8	.625	15.87500
9/64	.140625	3.57187	41/64	.640625	16.27187
5/32	.15625	3.96875	21/32	.65625	16.66875
11/64	.171875	4.36562	43/64	.671875	17.06562
3/16	.1875	4.76250	11/16	.6875	17.46250
13/64	.203125	5.15937	45/64	.703125	17.85937
7/32	.21875	5.55625	23/32	.71875	18.25625
15/64	.234375	5.95312	47/64	.734375	18.65312
1/4	.250	6.35000	3/4	.750	19.05000
17/64	.265625	6.74687	49/64	.765625	19.44687
9/32	.28125	7.14375	25/32	.78125	19.84375
19/64	.296875	7.54062	51/64	.796875	20.24062
5/16	.3125	7.93750	13/16	.8125	20.63750
21/64	.328125	8.33437	53/64	.828125	21.03437
11/32	.34375	8.73125	27/32	.84375	21.43125
23/64	.359375	9.12812	55/64	.859375	21.82812
3/8	.375	9.52500	7/8	.875	22.22500
25/64	.390625	9.92187	57/64	.890625	22.62187
13/32	.40625	10.31875	29/32	.90625	23.01875
27/64	.421875	10.71562	59/64	.921875	23.41562
7/16	.4375	11.11250	15/16	.9375	23.81250
29/64	.453125	11.50937	61/64	.953125	24.20937
15/32	.46875	11.90625	31/32	.96875	24.60625
31/64	.484375	12.30312	63/64	.984375	25.00312
1/2	.500	12.70000	1	1.00	25.40000

LIFTING, JACKING, AND SUPPORT POINTS

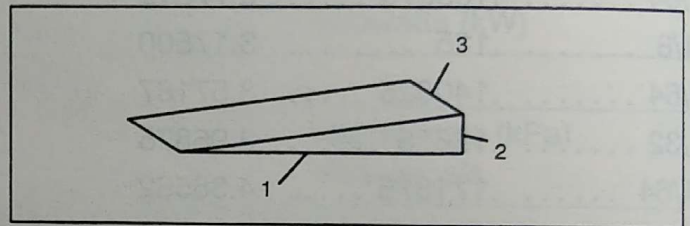
CAUTION: TO HELP AVOID PERSONAL INJURY WHEN A VEHICLE IS ON A HOIST, PROVIDE ADDITIONAL SUPPORT FOR THE VEHICLE. THIS WILL REDUCE THE POSSIBILITY OF THE VEHICLE FALLING OFF THE HOIST.

CAUTION: TO HELP AVOID PERSONAL INJURY, ALWAYS USE JACK STANDS WHEN WORKING ON OR UNDER ANY VEHICLE THAT IS SUPPORTED ONLY BY A FLOOR JACK OR A HOIST.

NOTICE: When lifting with a frame contact hoist, and battery pack removal is not necessary, lift the vehicle on the body side frame-lower pinch weld flanges at specific lift locations. (Location views on next page).

NOTICE: Because of the uniqueness of the design of the EV1 and its ground clearance, it is necessary to follow the hoisting directions very carefully. With an inground two post front and rear hoist, it may be necessary to use either low profile arms or ramps as needed in the front lift pad area to keep the fascia from being damaged when approaching or leaving the hoisting area. Ramp size needed:

1. 1050 mm in length
(41-3/8 in.)
2. 155 mm in height
(6-7/64 in.)
3. 230 mm in width
(9-1/16 in.)

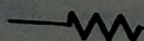


NOTICE: When lifting with a suspension contact hoist, position the front hoist lift pads under the lower control arms. Lift from under the rear tires for rear suspension. (Refer to "Hoisting/Lifting for a Two Post In Ground Hoist Front and Rear" in this section for more information and illustrations.)

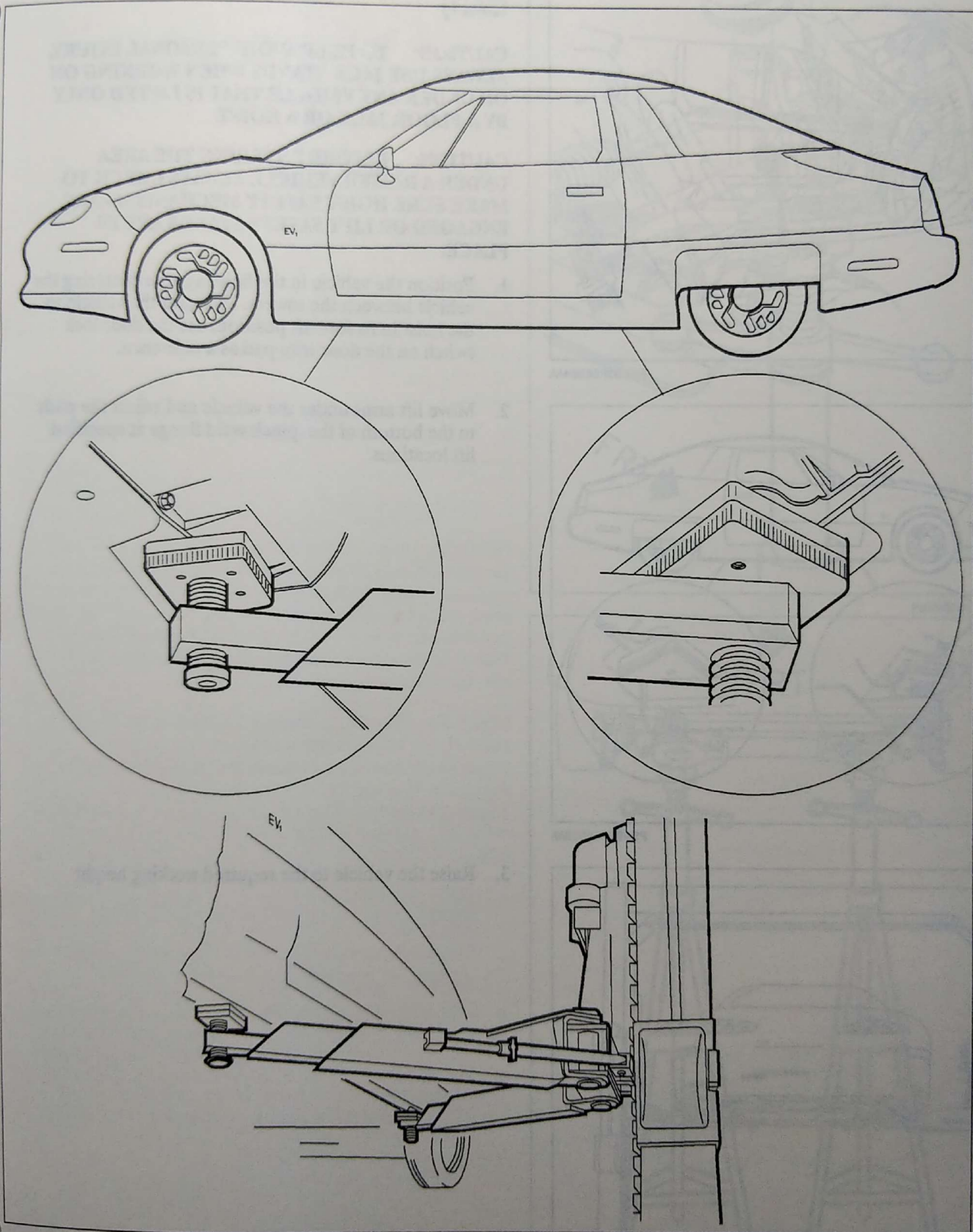
When battery pack removal is required, the use of two rear lift pad adaptors must be used. These lift pad adaptors are obtainable from:

General Motors Dealer Equipment

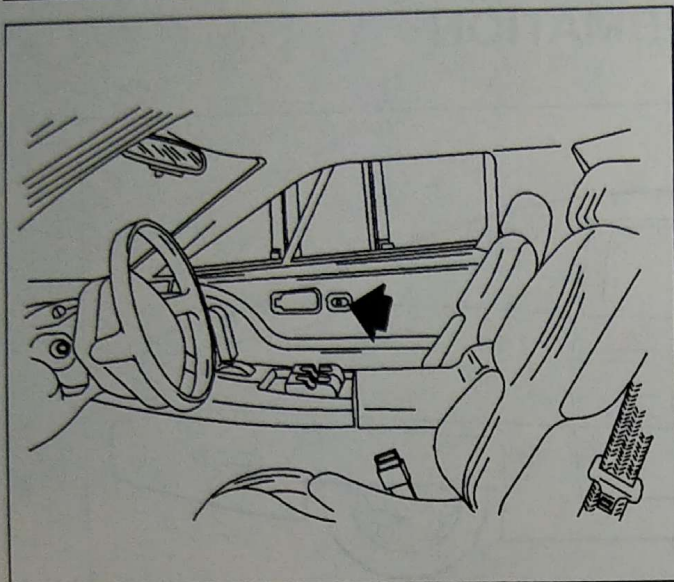
Telephone: 1-800-GM-TOOLS



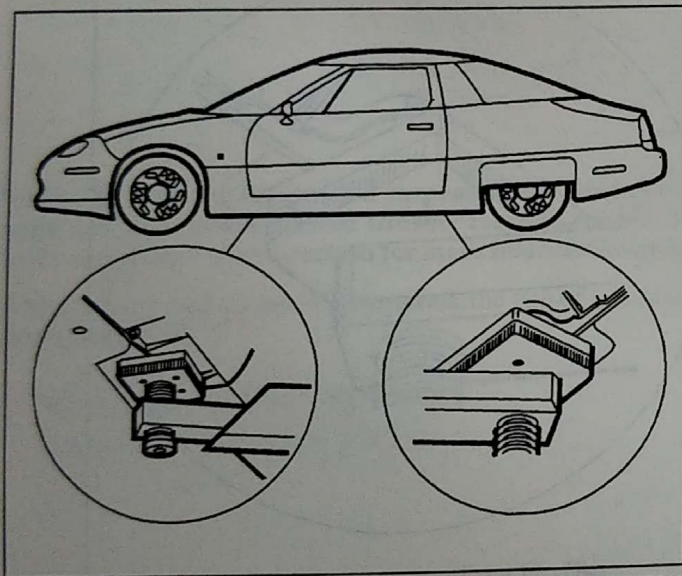
GENERAL INFORMATION



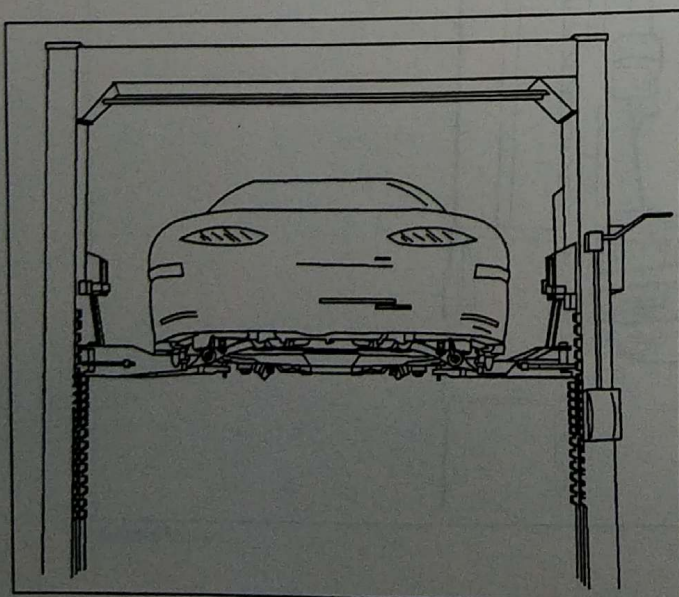
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PSMBSF66859AA



PSMBSF66534AA

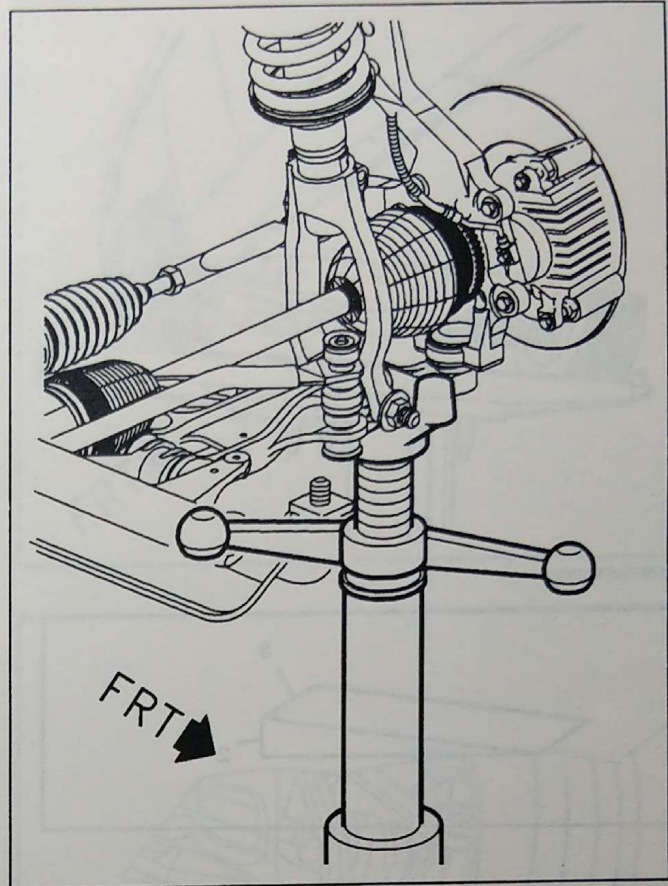
HOISTING/LIFTING FOR A 2 POST ABOVE GROUND HOIST - (SIDE CAR)

CAUTION: TO HELP AVOID PERSONAL INJURY, ALWAYS USE JACK STANDS WHEN WORKING ON OR UNDER ANY VEHICLE THAT IS LIFTED ONLY BY A FLOOR JACK OR A HOIST.

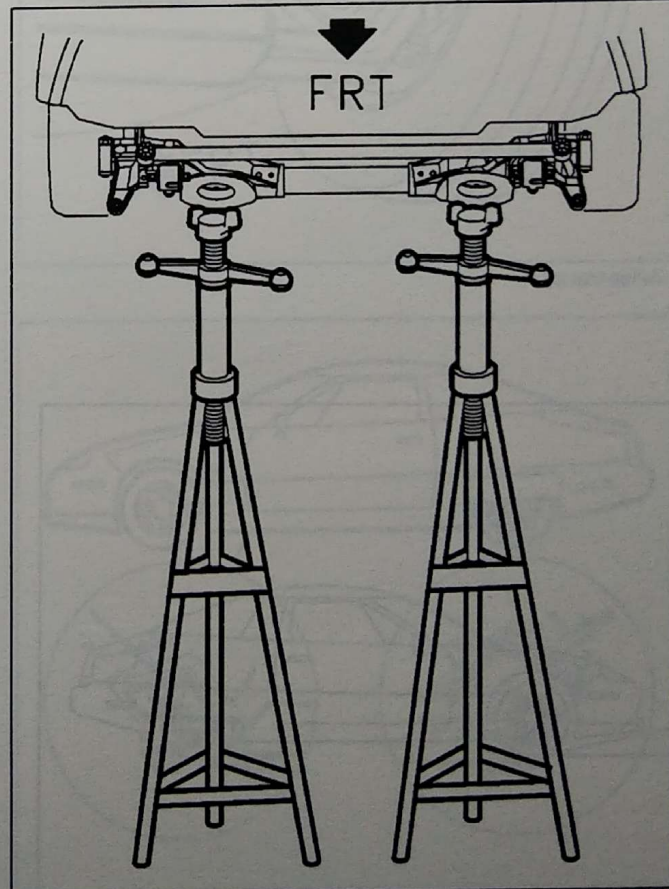
CAUTION: BEFORE ENTERING THE AREA UNDER A RAISED VEHICLE ALWAYS CHECK TO MAKE SURE HOIST SAFETY MECHANISMS ARE ENGAGED OR LIFT SAFETY STANDS ARE IN PLACE.

1. Position the vehicle in the hoisting area centering the vehicle between the towers. To center the vehicle to the hoist in its fore aft position, use the door lock switch on the door trim pad as a reference.
2. Move lift arms under the vehicle and adjust the pads to the bottom of the pinch weld flange at specified lift locations.
3. Raise the vehicle to the required working height

4. Position safety stands in place.



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HOISTING/LIFTING FOR A 2 POST INGROUND HOIST - (FRONT AND REAR)

CAUTION: BEFORE ENTERING THE AREA UNDER A RAISED VEHICLE ALWAYS CHECK TO MAKE SURE HOIST SAFETY MECHANISMS ARE ENGAGED OR LIFT SAFETY STANDS ARE IN PLACE.

NOTICE: When using an in ground hoist it is necessary to pay close attention to the ground clearance at the front end of the vehicle. Be careful not to damage any of the front end components.

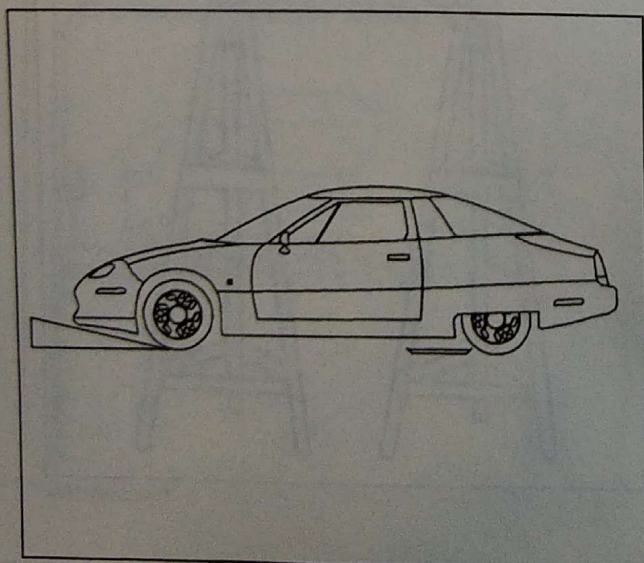
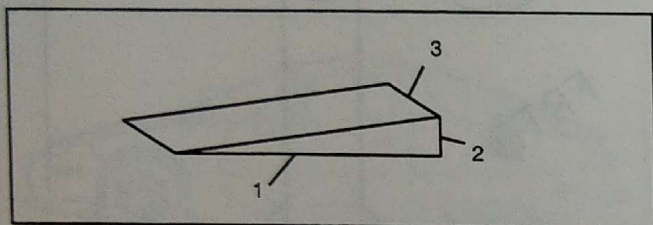
NOTICE: The aid of a ramp for some models of lifts is helpful for obtaining clearance under the front end of the vehicle. Proper clearance will keep the fascia and underbody components from being damaged when approaching or leaving the hoisting area. Ramp size needed:

1. 1050 mm in length (41-3/8 in.)
2. 155 mm in width (6-7/64 in.)
3. 230 mm in height (9-1/16 in.)

NOTICE: With the use of ramps, always have a partner who will be outside and in front of the vehicle guide and watch to ensure that proper alignment is achieved to the ramps and hoisting area. Be careful that you don't drive over or slip off the edge of the ramps. Failure to do so could result in damage to under body and mechanical components.

NOTICE: The first vehicle to be lifted using the ramp method may take several attempts to get properly aligned to the hoist pads under the front of the body structure. Marking the floor with tape, paint or permanent marker after the ramp position is determined will aid in the positioning ramps for future EV1 vehicle lifting.

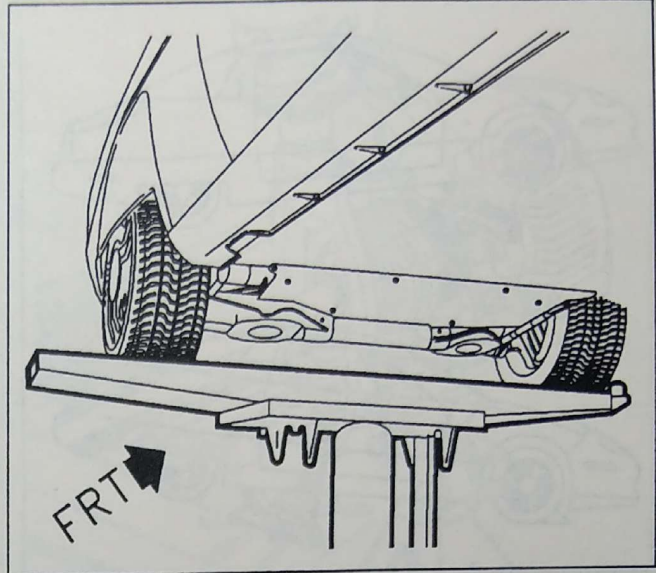
1. Drive the vehicle up to the hoisting area, centering the vehicle to the hoist in its side to side position.
2. Drive vehicle forward until the front of the rear tires contact the rear edge of the rear tire lift tray.
3. Place the ramps on the floor. In front of the vehicle, center each ramp in front of the front tires.
4. Slide ramps rearward until they touch the front of the front tires, or align ramps to markings on floor made from previous lifting as described in the above "NOTICE."



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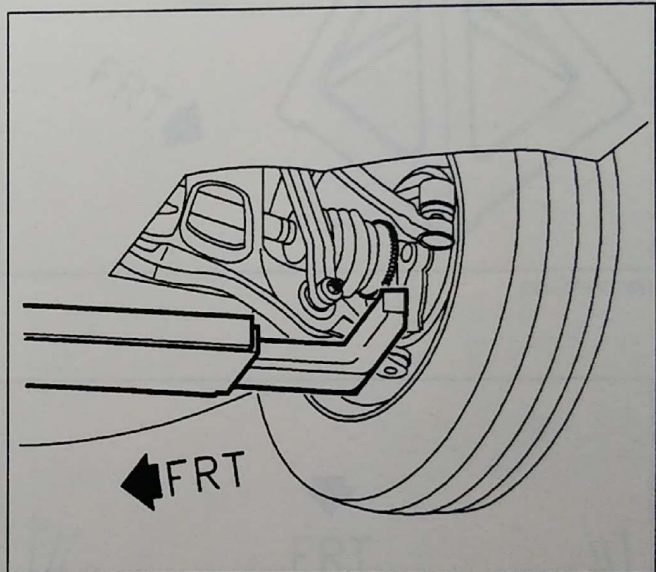


5. Drive forward and up the ramps until the rear tires are centered in the rear tire tray portion of the hoist.



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6. Put the front lift pads under the vehicle's front lower control arms at the portion between the ball joint and the yoke.
7. Lift the vehicle to proper working height and position safety stands. (Refer to "Lifting, Jacking, and Support Points" and "Hoisting Lifting with a Floor Jack" sections in this section.)

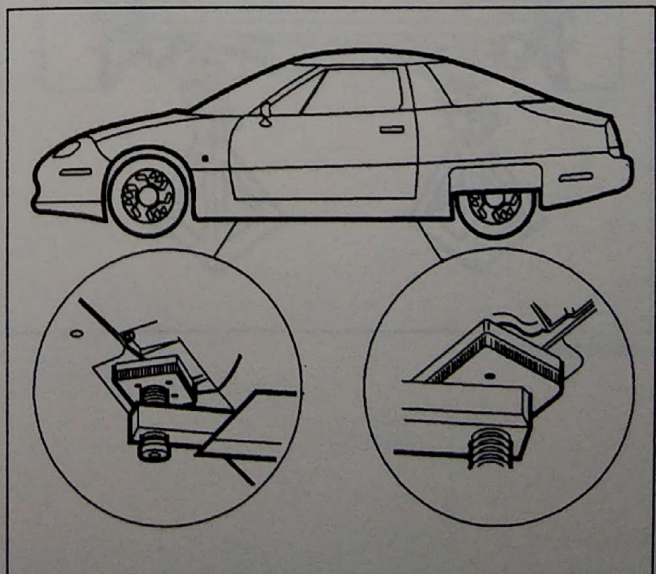


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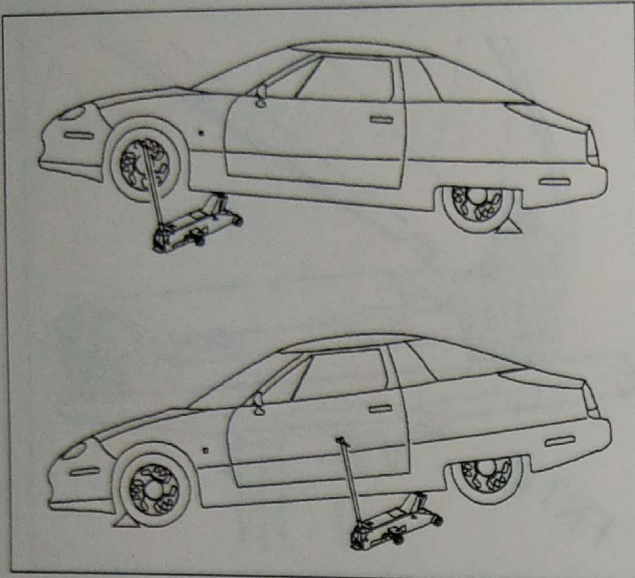
LIFTING WITH A FLOOR JACK

NOTICE: Do not put floor jack under any portion of the vehicle other than locations shown or damage to the structure may occur.

1. Locate the rocker panel pinch weld flange lift/hoist areas, place floor jack in position, seat the lift pad in place, and chock the wheels. (Refer to "General Information" in the "Lifting, Jacking, and Support Points" section in this section.)



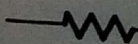
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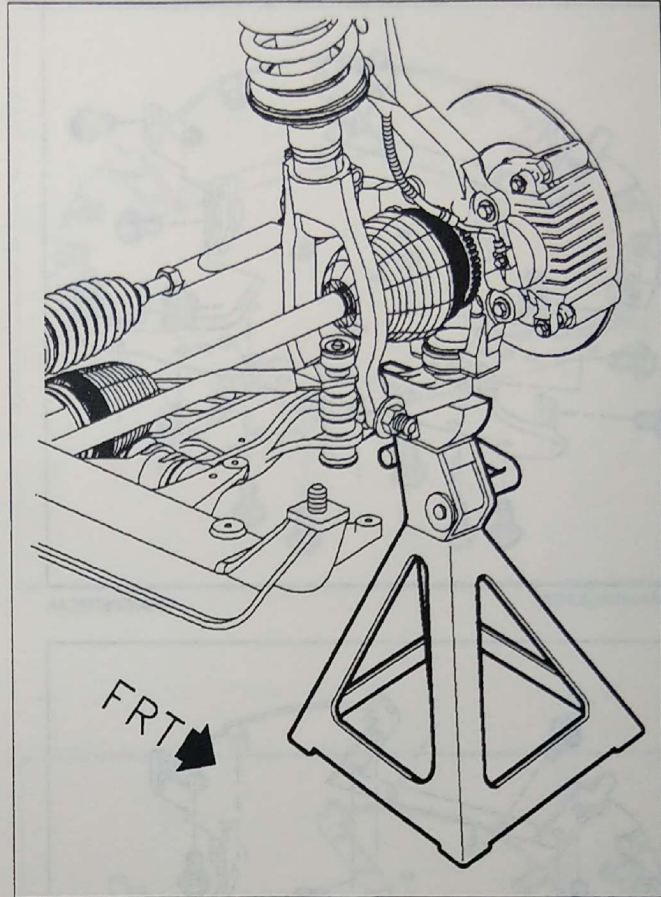
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CAUTION: TO HELP AVOID PERSONAL INJURY, ALWAYS USE JACK STANDS WHEN WORKING ON OR UNDER ANY VEHICLE THAT IS LIFTED BY A FLOOR JACK OR A HOIST.

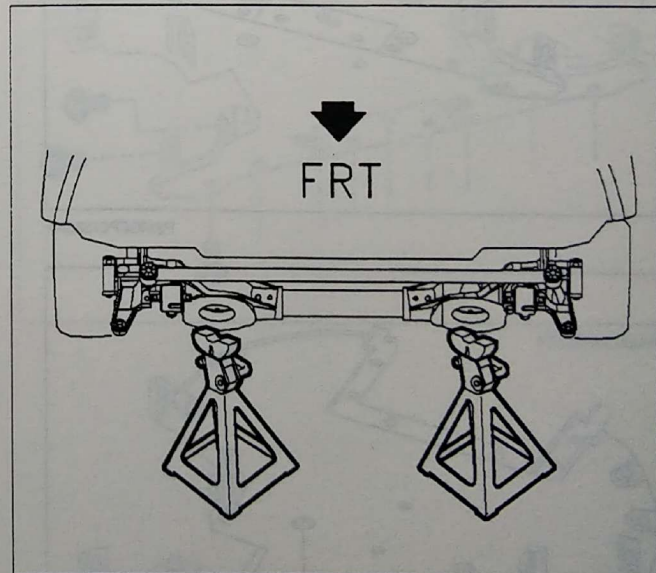
2. Lift vehicle with floor jack.



3. Once the vehicle is at the required working height install safety stands.



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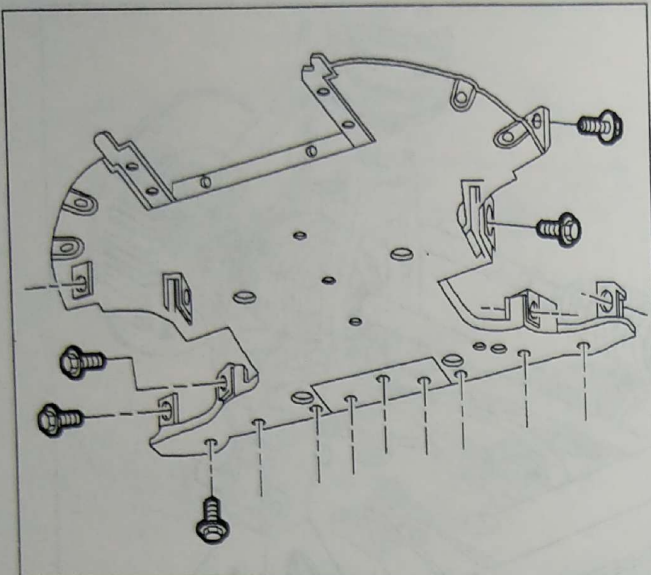
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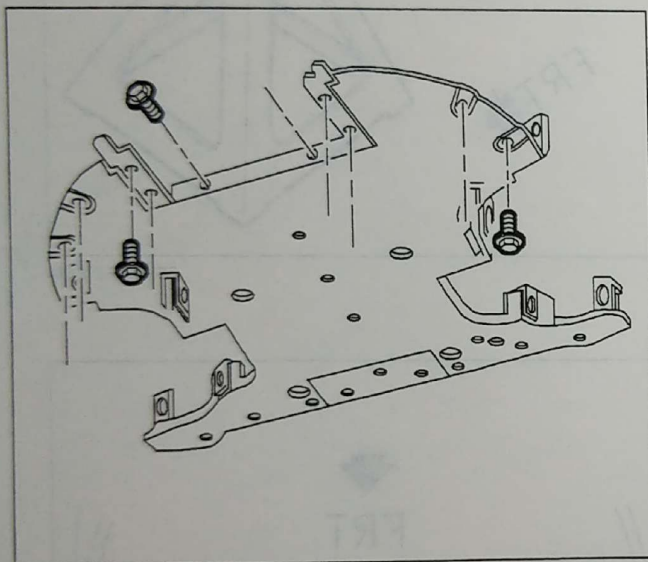
UNDERBODY FRONT AIR DEFLECTOR

REMOVAL

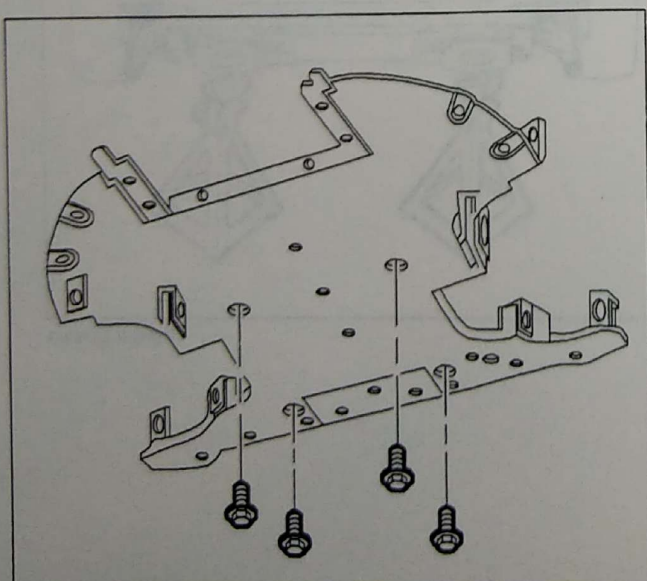
1. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" section in this manual.)
2. Remove bolts retaining underbody front air deflector to underbody center air deflectors.
3. Remove bolts retaining underbody front air deflector to front wheelhouse panel liners.
4. Remove bolts retaining underbody front air deflector to front bumper fascia assembly.
5. Remove bolts retaining underbody front air deflector to condenser radiator fan module (CRFM) bracket.
6. Remove bolts retaining underbody front air deflector to side baffles.
7. Remove bolts retaining underbody front air deflector to drivetrain and front suspension crossmember assembly.
8. Lower underbody front air deflector and disengage tabs from front bumper fascia assembly.



PSMGEP67582AA



PSMGEP67583AA



PSMGEP67581AA



INSTALLATION

IMPORTANT: If bolt threads or "J" nuts threads are damaged during removal or installation, remove bolt and fastener, inspect, and replace if necessary.

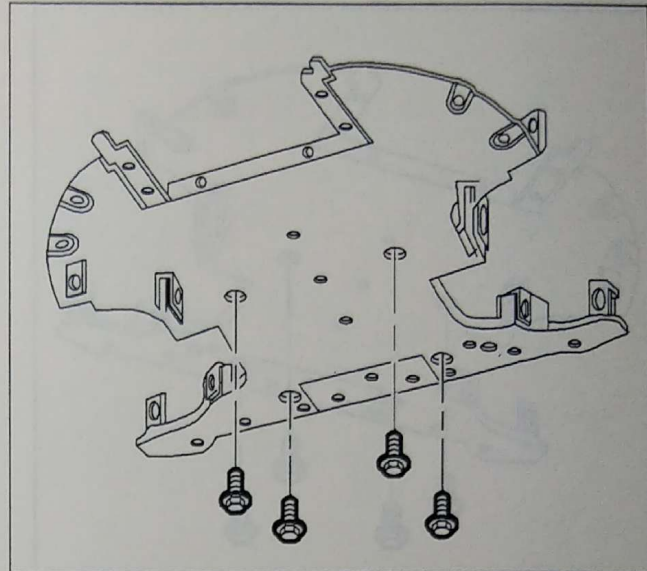
1. Raise front edge of air deflector and engage tabs into retaining slots on front bumper fascia assembly.
2. Raise and support underbody front air deflector to underside of vehicle.

IMPORTANT: Flange on air deflector must be located forward of condenser radiator fan module (CRFM) bracket.

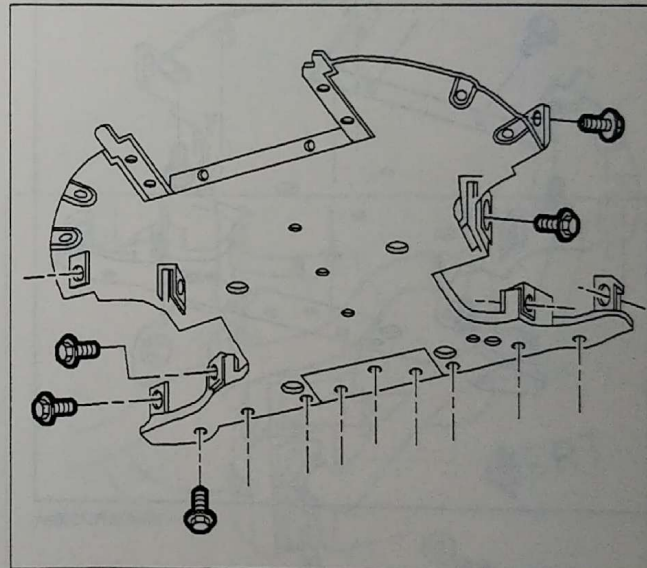
3. Loosely install bolt retaining air deflector to CRFM bracket.
4. Loosely install bolts retaining underbody front air deflector to front mounting locations of drivetrain and front suspension crossmember assembly.
5. Loosely install bolts retaining underbody front air deflector to rear mounting locations of drivetrain and front suspension crossmember assembly.
6. Install and tighten bolts retaining underbody front air deflector to underbody center air deflectors. Torque as specified.

Torque: 6 N•m (53 in-lbs)

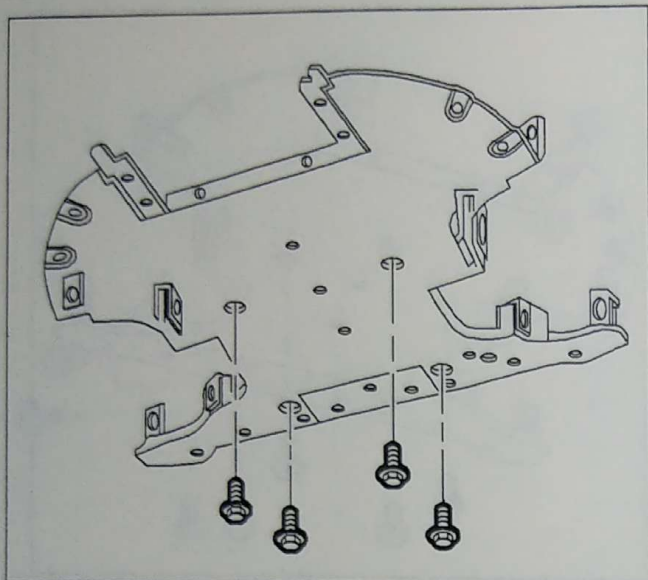
IMPORTANT: If cradle bolt begins to cross thread during installation, stop immediately, remove bolt, then run thread tap (M6.0 mm x 1.0) into insert to repair damaged threads.



PSMGEP67581AA



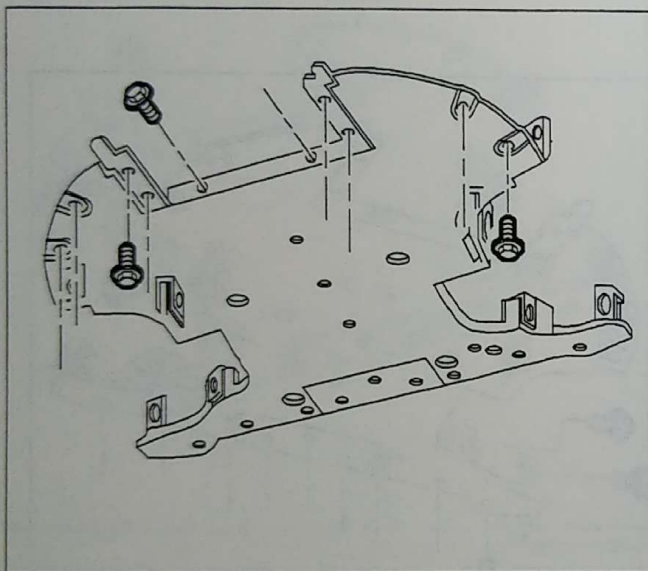
PSMGEP67582AA



PSMGEP67581AA

7. Tighten bolts retaining underbody front air deflector to front mounting locations of drivetrain and front suspension crossmember assembly. Torque as specified.

Torque: 6 N•m (53 in-lbs)



PSMGEP67583AA

IMPORTANT: At CRFM attachment, position air deflector flange so that it rests up against the bottom of the CRFM lower support.

8. Install and tighten bolt retaining underbody front air deflector to CRFM bracket. Torque as specified.

Torque: 6 N•m (53 in-lbs)

9. Tighten remaining bolt retaining air deflector to CRFM bracket. Ensure underbody front air deflector is up against bottom of CRFM lower support. Torque as specified.

Torque: 6 N•m (53 in-lbs)

10. Install and tighten bolts retaining underbody front air deflector to CRFM to fascia close-out side baffles. Torque as specified.

Torque: 6 N•m (53 in-lbs)

11. Install and tighten bolts retaining underbody front air deflector to front bumper fascia assembly. Torque as specified.

Torque: 6 N•m (53 in-lbs)

12. Install and tighten bolts retaining underbody front air deflector to front wheelhouse panel liner on one side of the vehicle. Front tires may need to be rotated to access mounting locations. Torque as specified.

Torque: 6 N•m (53 in-lbs)

13. Install and tighten bolts retaining underbody front air deflector to front wheelhouse panel liner on opposite side of the vehicle. Front tires may need to be rotated to access mounting locations. Torque as specified.

Torque: 6 N•m (53 in-lbs)

14. Lower vehicle and turn front wheels to face in a straight ahead position.



POWER ELECTRONICS BAY (PEB)

REMOVAL

CAUTION: TO REDUCE THE RISK OF SEVERE SHOCKS AND BURNS, THE HIGH VOLTAGE SYSTEM SHOULD BE DISABLED ANY TIME SERVICE WORK IS BEING PERFORMED ON OR AROUND THE HIGH VOLTAGE SYSTEM. WHEN IN DOUBT, ALWAYS DISABLE THE HIGH VOLTAGE SYSTEM. THE 12 VOLT SYSTEM WILL STILL BE ACTIVE AFTER THE HIGH VOLTAGE SYSTEM HAS BEEN DISABLED.

1. Disable high voltage. (Refer to "High Voltage Disable" in this manual.)
2. Disable 12 volt system. (Refer to "12 Volt System Disable" in this manual.)

IMPORTANT: Do not remove expansion tank cover or open cooling system drains from a hot system. Allow system to cool first.

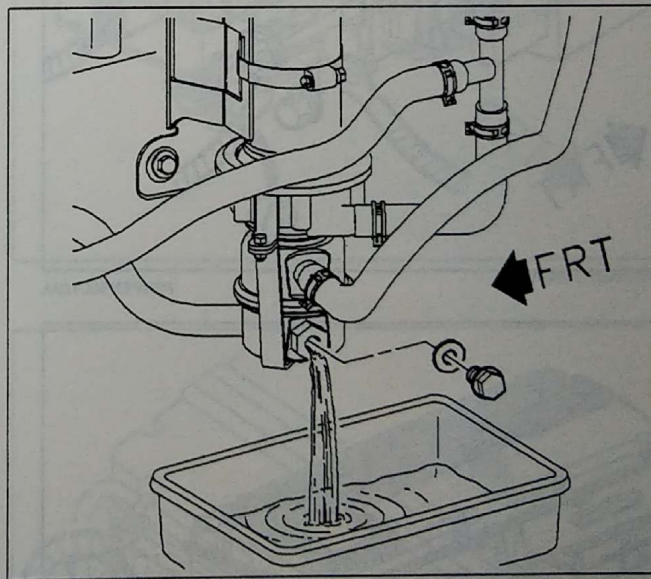
3. Remove the expansion tank cover.
4. Raise the vehicle on a hoist. (Refer to "Lifting, Jacking, and Hoisting" section in this manual.)
5. Remove front underbody air deflector. (Refer to "Front Underbody Air Deflector Removal" procedure in this manual.)
6. Position drain pan under water pump manifold.

IMPORTANT: A two gallon container will be required to hold the coolant.

7. Remove the drain plug and gasket from the water pump manifold allowing the coolant to flow from the main path.
8. After coolant has drained from the main path, reinstall water pump manifold drain plug and gasket.

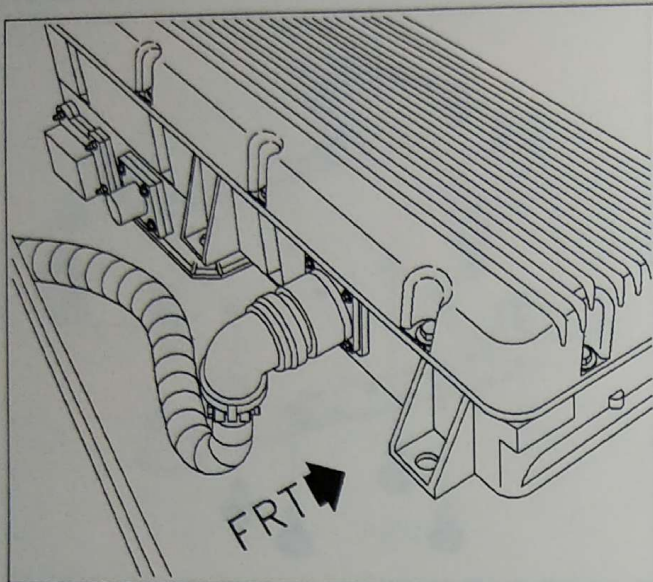
Torque: 11 N•m (97 in-lbs)

9. Lower vehicle.

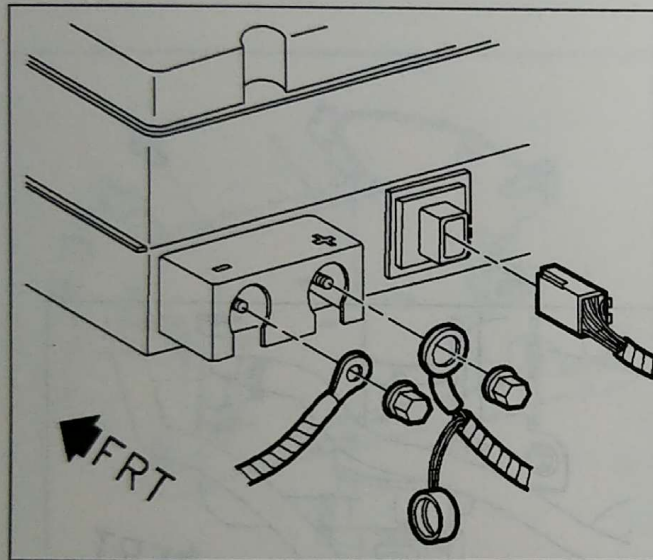


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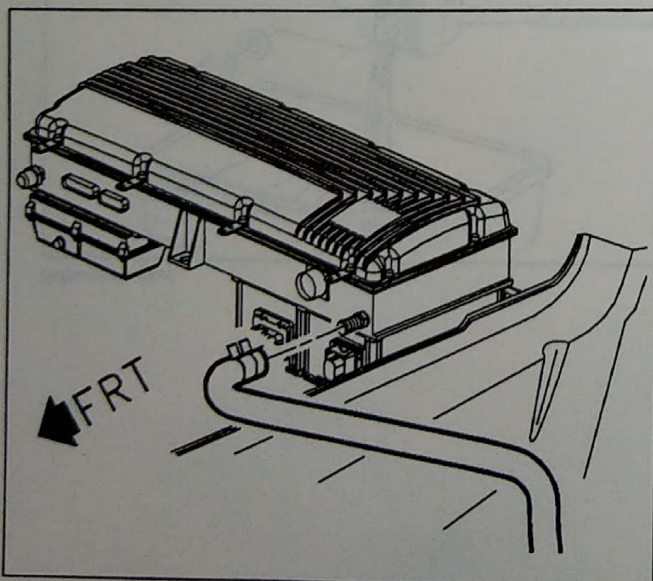




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PSMPEN66019AA



PSMPEN66020AA

10. Disconnect the battery assembly to power inverter module (PIM) cannon connector from the right rear corner of the PEB.

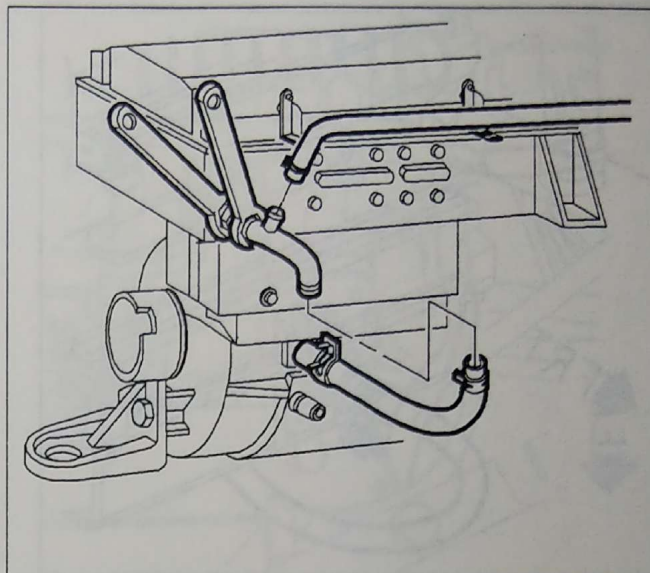
11. Disconnect the accessory AC and DC power control module (APM) 5-way connector from the rear of the PIM.

12. Remove the negative and positive battery cables from the PIM. Voltage should not be present at these connections. If voltage is present verify that all steps of low and high voltage disable have been completed.

13. Disconnect the driver side coolant hose from the PIM.

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, fittings or components

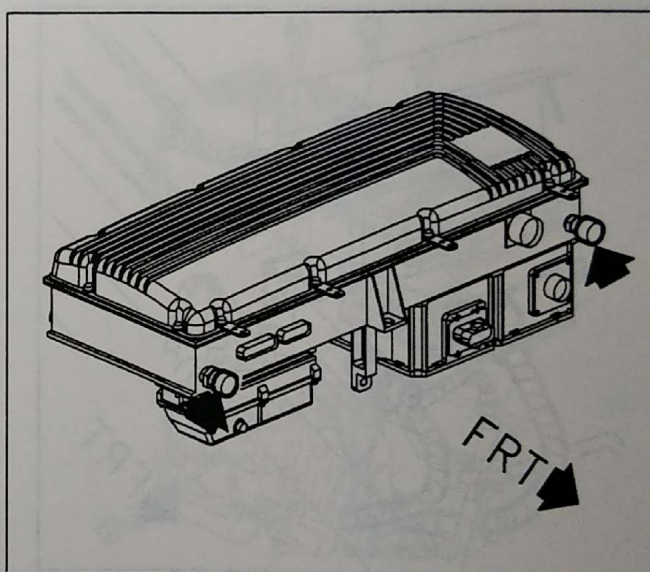
14. Disconnect the passenger side coolant hose from PIM only.



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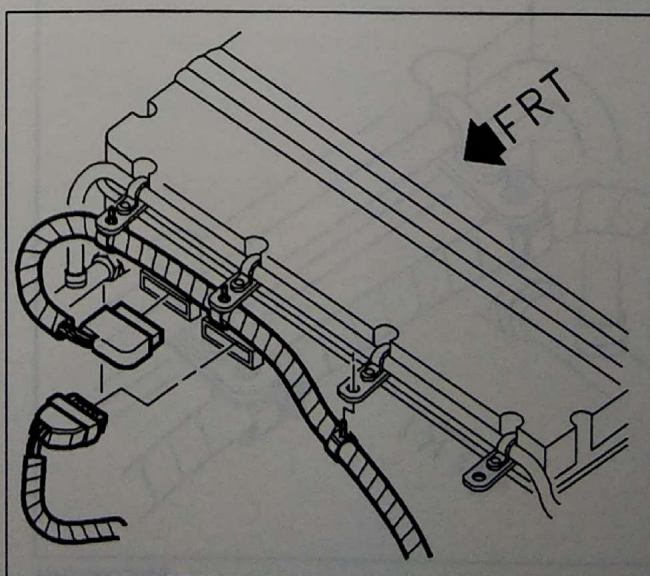
15. Install coolant plugs to prevent coolant leakage during removal.

IMPORTANT: If coolant plugs are not available, tape the cooling fittings.

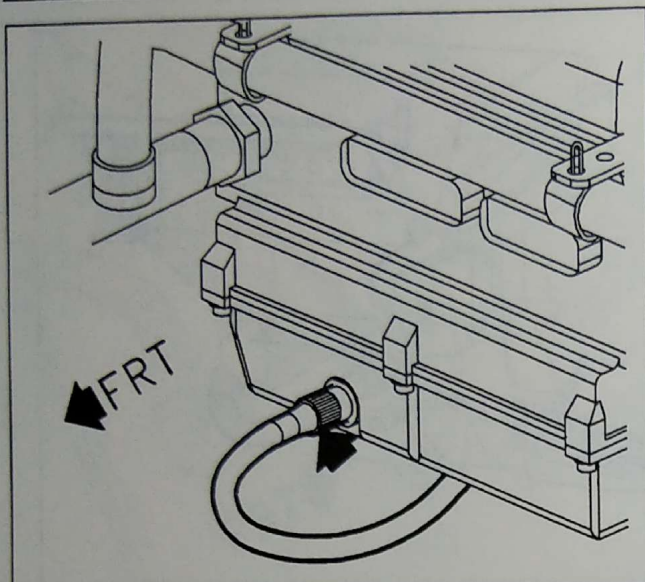


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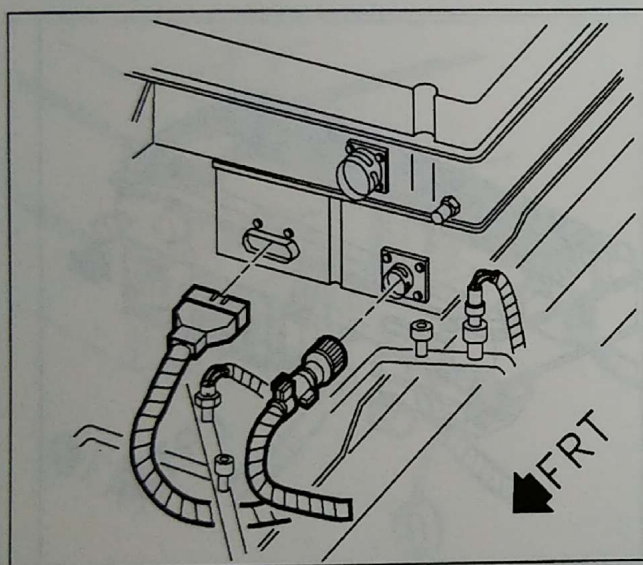
16. Remove the 32-way and the 24-way connectors at the forward right corner of the PIM. To remove the connectors squeeze the connector retainer and pull outward.



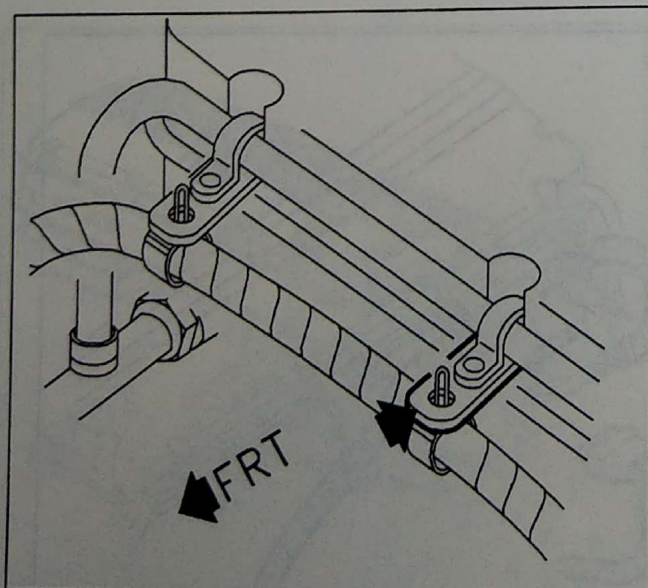
PSMPEN66075AA



PSMPEN66278AA



PSMGCH66073AA



PSMPEN66074AA

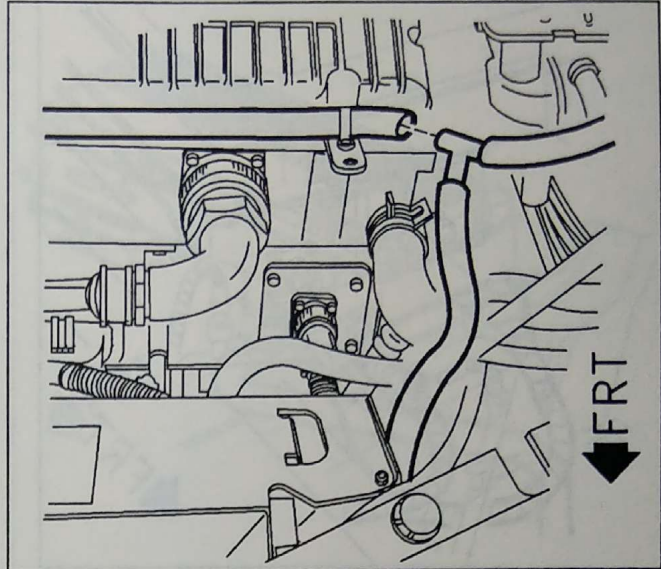
17. Disconnect the power steering control module (PSCM) 5-way connector at the PSCM.

18. Disconnect the accessory AC and DC power control module (APM) 24-way and small cannon connector at the forward left side of the APM.

IMPORTANT: Do not remove the PIM top cover screws.

19. Remove the wire clips retaining the PEB harness to the front PIM cover brackets and remove the PEB harness away from the PEB.

20. Remove the coolant hose at the "T" going into the expansion tank.



PSMPEN66021AA

21. Remove the lower PEB to drive unit bolt located just to the right of the PEB center, below the top of the engine strut.
22. Remove the remaining PEB to drive motor bolts.
23. Using two people, one at each end of the PEB lift the assembly straight up disconnecting it from the drive motor and continue lifting until the lower attachment tab clears the front of vehicle. Remove the PEB.

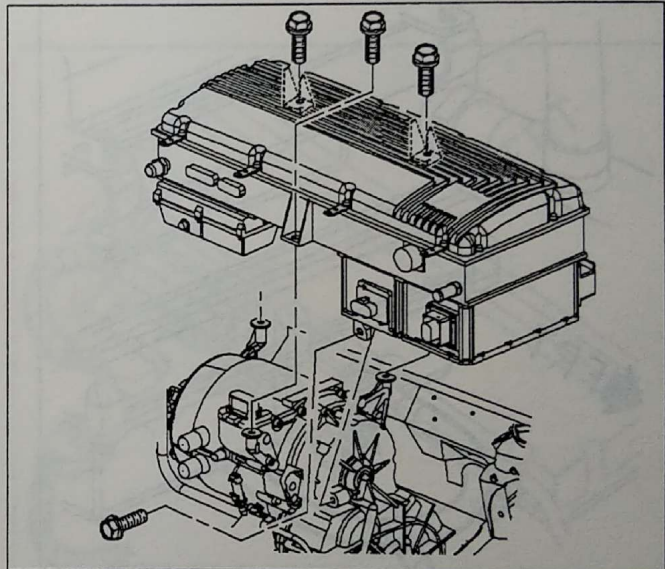
INSTALLATION

1. Using two people position the PEB over the drive motor connection point. Carefully lower the PEB over the drive motor and into position.
2. Install the top PEB to drive motor bolts. Lightly tightened all bolts.
3. Install the lower PEB to drive motor bolt located just to the right of the PEB center, below the top of the engine strut.

Torque: 35 N•m (26 ft-lbs)

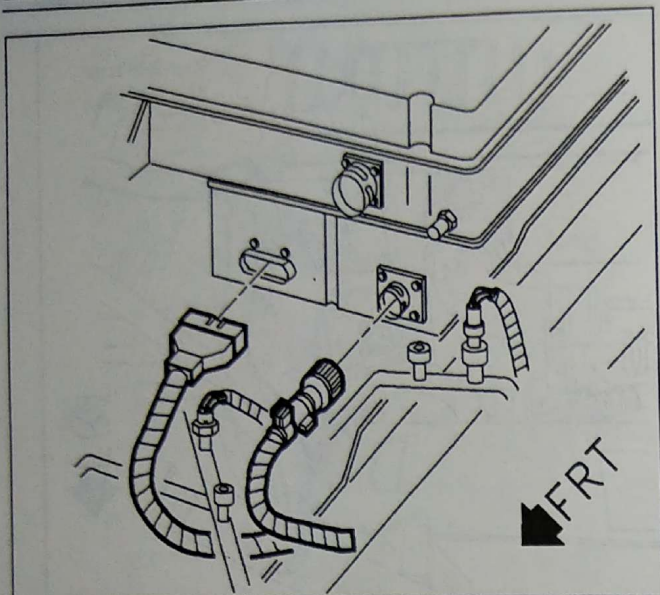
4. Torque the top PEB to motor bolts

Torque: 63 N•m (46 ft-lbs)



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5. Connect the APM 24-way connector and the APM cannon connector.

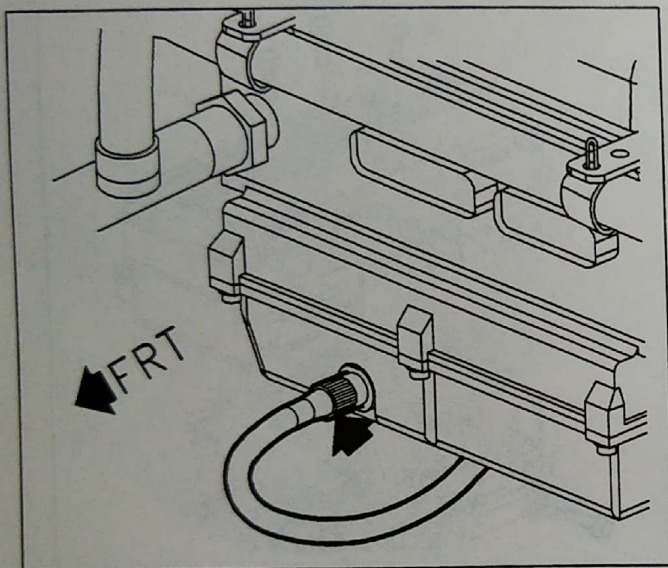


PSMGCH66073AA

6. Connect the PSCM 5-way connector (yellow cable).

NOTICE: Make sure connector is properly aligned to the connection at the PSCM prior to installation, this will help avoid damaging connector pins.

7. Remove the two PIM coolant plugs.

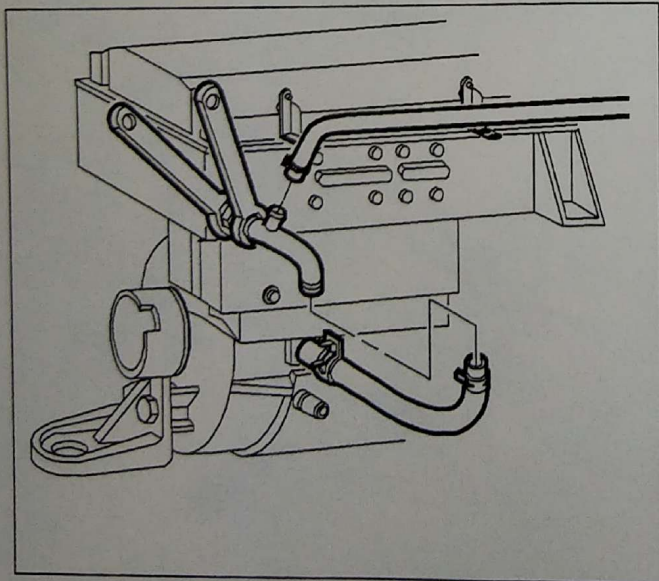


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8. Install cooling outlet hose to PIM.

Torque: 36 N•m (27 ft-lbs)

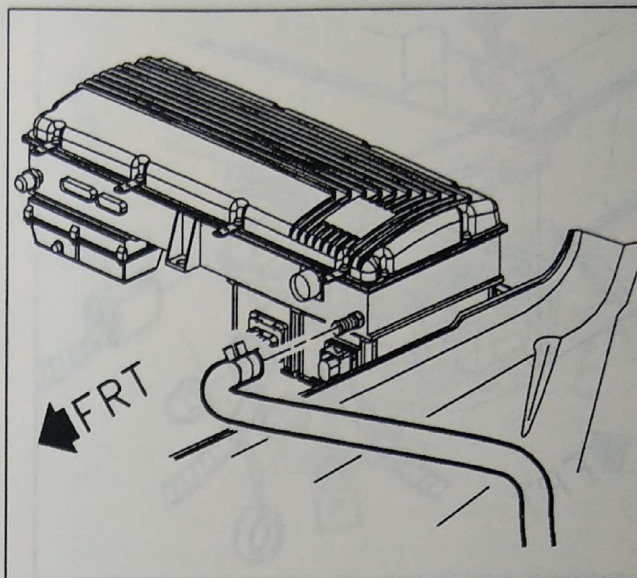
NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, fittings or components



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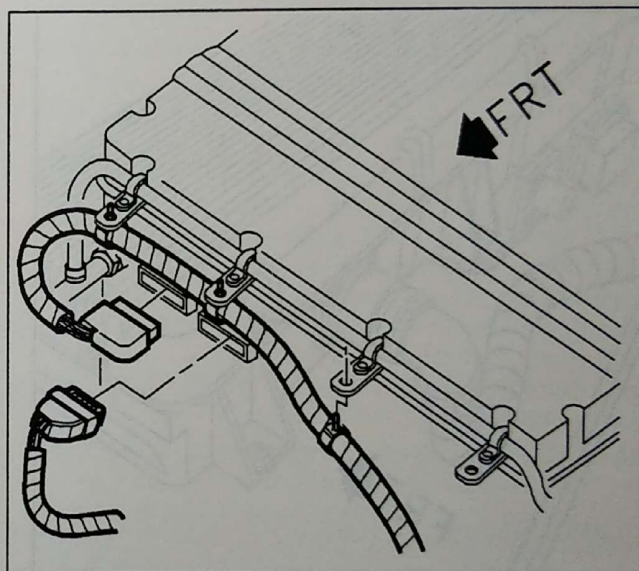


9. Install hose and clamp on PIM inlet cooling fitting. Position clamp tangs at 2 o'clock.



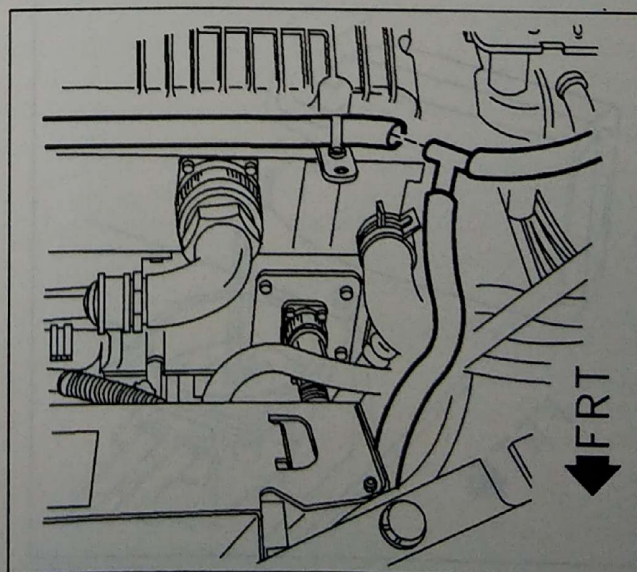
PSMPEN66020AA

10. Connect 32-way and the 24-way connectors at the front of the PIM.
11. Install the wire clips to retain PEB harness to the front PIM cover brackets.



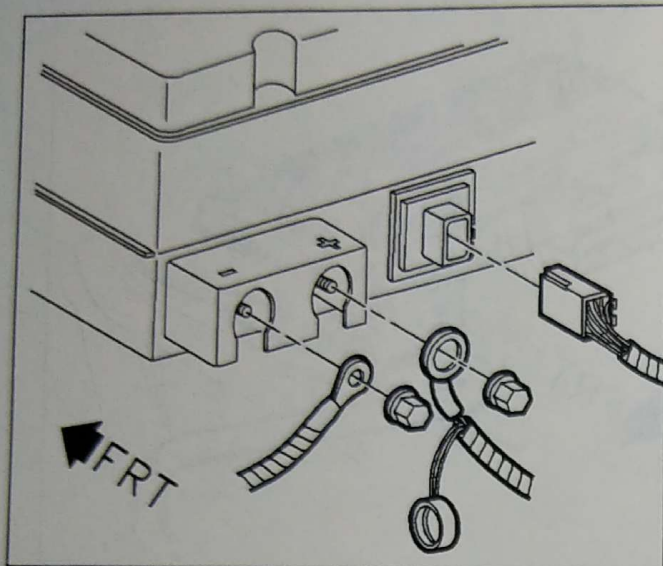
PSMPEN66075AA

12. Install vent hose to vent "T."



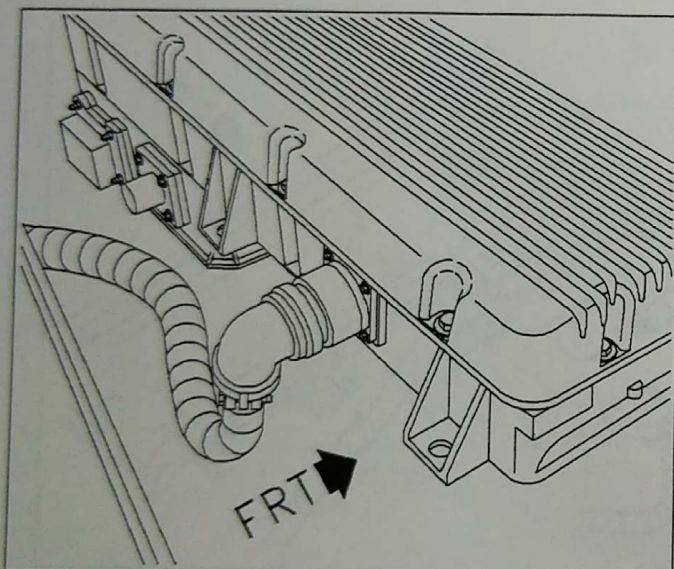
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13. Connect the APM, 5-way connector at the rear of the APM.
14. Connect the negative and positive battery cables to the left rear of the APM.

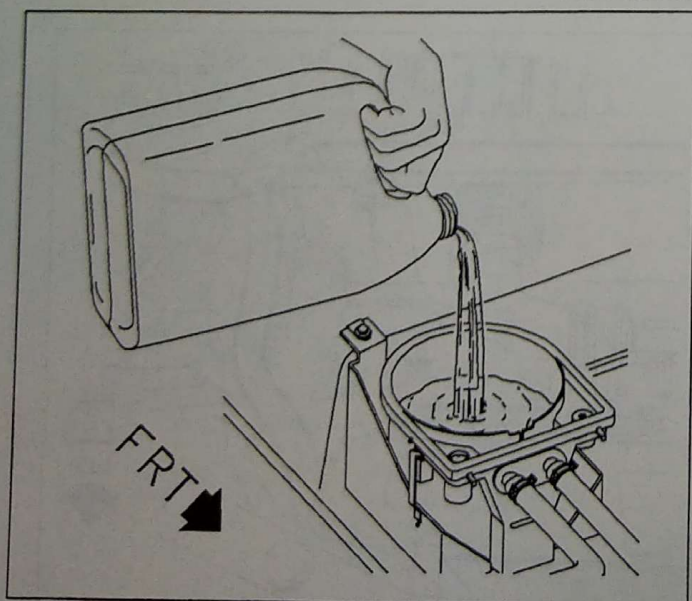


PSMPEN66279AA

15. Connect battery assembly pack cannon connector to right rear corner of the PIM. Tighten connector until indicator marks line-up.

NOTICE: Do not use any tools to reinstall the connector. Excessive force or misalignment can damage the connector pins.

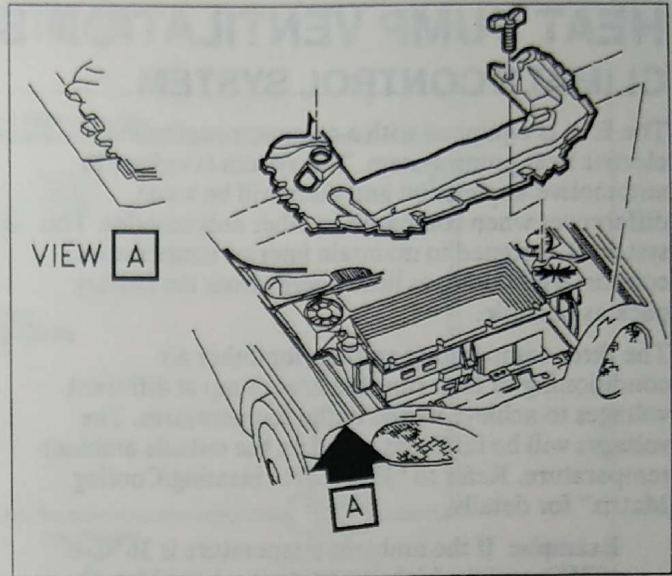
16. Enable high voltage. (Refer to "High Voltage Enable" in this manual.)



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17. Check to insure that all the hoses and fittings are connected.
18. Fill coolant system until you reach the fill line on the expansion tank with GMEV coolant part 27002485 or equivalent which meets GM spec #9986100. The fluid level will drain down into the coolant system slowly and fluid should be added until the fluid level stabilizes.
19. Place vehicle in run mode. If vehicle does not power-up, refer to the "High Voltage" section of the service manual.
20. Maintain fluid level to fill line in expansion tank.
 - a. After one minute turn on heat mode. Maintain fluid level to fill line in expansion tank.
 - b. After one minute turn on vent mode.

21. Repeat previous step two more times.
22. After one minute turn on heat mode.
23. Insert charger paddle into charger receptacle. Verify charger is operating.
24. Maintain fluid level to fill line in expansion tank.
25. After one minute remove charger paddle from charger receptacle.
26. Turn HVAC system to vent mode.
27. Insert charger paddle into charger receptacle. Verify charger is operating.
28. After two minutes remove charger paddle from charger receptacle. Top off fluid level to fill line, install cover on expansion tank and check for leaks.
29. Install engine compartment sight shield.
30. Clear all codes using PDT.
31. Raise vehicle on hoist.
32. Install front underbody air deflector. (Refer to "Front Underbody Air Deflector Installation" procedure in this manual.)



PSMCEP65869AC



HVAC 47

HEAT PUMP VENTILATION SYSTEM INTRODUCTION

CLIMATE CONTROL SYSTEM

The EV1 is equipped with a computer controlled electric heat pump system. This system is unique in automotive application and there will be some differences when compared to other automobiles. This system is designed to maintain interior temperature comfort while using as little energy from the battery pack as possible.

The three temperature settings for either air conditioning or heat runs the heat pump at different voltages to achieve varied outlet temperatures. The voltages will be different based on the outside ambient temperature. Refer to "EV1 Cabin Heating/Cooling Matrix" for details.

Example: If the ambient temperature is 36°C (97°F) and the highest setting is selected for air conditioning, the system will begin operation at the highest rated level of current to obtain 2000 watts, then operate in steady state mode at 1625 watts. The same selection at 30°C (86°F) will start up the same, but operate at 1125 watts in steady state mode.

Heat pumps are refrigeration machines. Refrigeration involves the removal of heat from a place where it is not wanted and depositing it in a place where it make no difference. The heat can actually be deposited in a place where it will do some good. This is the difference between a heat pump and a summer air conditioner. The air conditioner can only pump heat one way. The heat pump is a refrigeration machine that can pump heat two ways. It is normally used for space conditioning, heating and cooling.

The EV1 heat pump systems six major components are the front end heat exchanger (condenser), the compressor, the orifice tube, the cabin heat exchanger (evaporator), the reversing valve, and the heat pump ventilation system/thermal control module (HTCM).

The heat exchangers either absorb heat or reject heat that has been absorbed into the vapor within the heat exchangers. The compressor pumps the heat-laden vapor through the system. The orifice tube is a metering device that controls the refrigerant flow. The reversing valve changes the direction of the refrigerant within the system to change from heating to cooling. The HTCM monitors cabin and ambient temperature, vapor temperature and pressure in the system, and adjust the system performance versus power consumption to optimize driving range.

COOLING MODE

When the heat pump system is in the cooling mode and the ambient temperature is greater than 19°C (66°F), the refrigerant vapor going into the cabin heat exchanger (evaporator) is cool. As the hot air passes through the evaporator, the refrigerant vapor absorbs the heat from inside the car and the compressor moves the heat soaked vapor to the front end heat exchanger (condenser), as the cooler outside air passes through the condenser, the air is warmed removing the heat

from the refrigerant, the cooled refrigerant then goes back to the cabin to start the cycle again.

When the heat pump system is in the cooling mode and the ambient temperature is less than or equal to 19°C (66°F) the indicator lights on the run/lock shifter assembly will come On but the heat pump system will not operate. Vent mode will be the only method of cooling the interior, available at these temperatures.

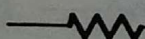
HEATING MODE

When the heat pump system is in the heating mode and the ambient temperature is less than or equal to 19°C (66°F), the refrigerant vapor going into the cabin heat exchanger (evaporator) is warm, as the cool cabin air passes through the evaporator it absorbs the cold from inside the car, the compressor is moving the cooler soaked vapor to the front end heat exchanger (condenser), as the outside air passes through the cold condenser the air is cooled removing the lower temperature from the refrigerant, the warm refrigerant then goes back to the cabin to start the cycle again. Powertrain coolant is also circulated through the heater core assisting in the heating of the EV1.

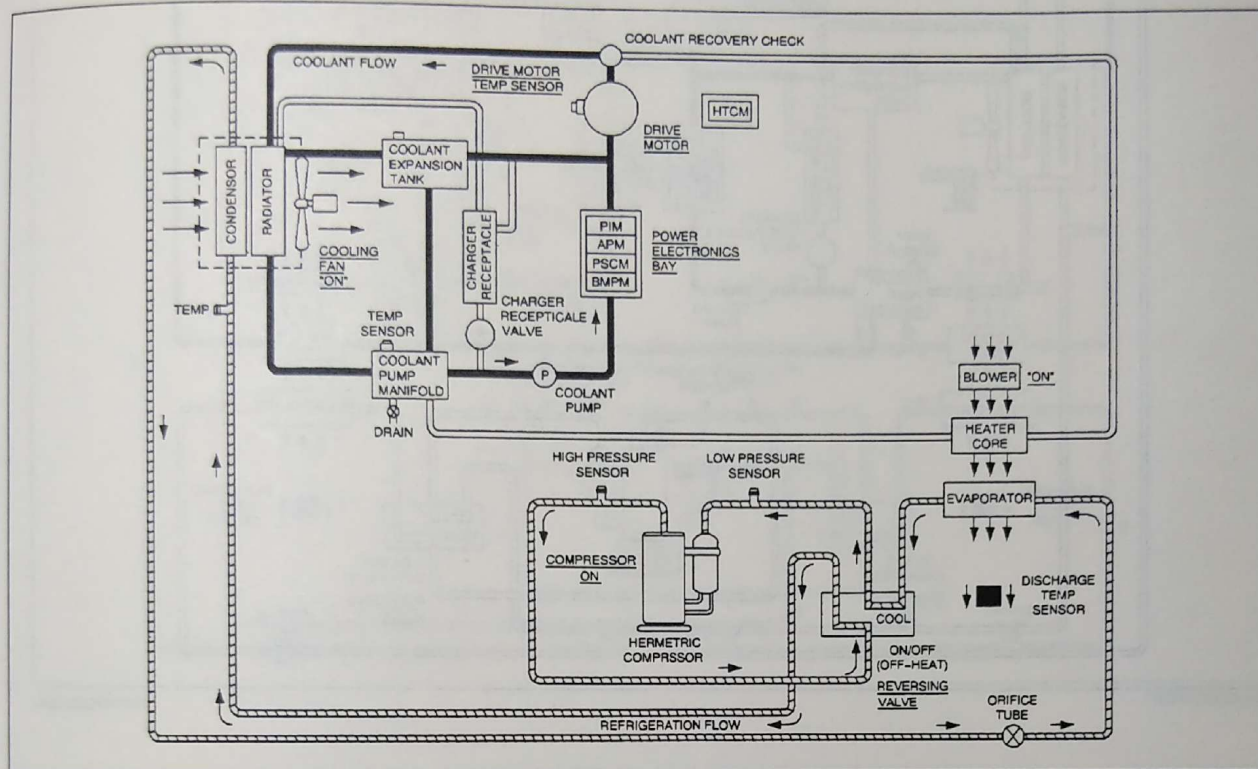
When the heat pump system is in the heating mode and the ambient temperature is greater than 19°C (66°F), the heat pump compressor will not come on. Heating during this temperature range will be accomplished using heat generated from the coolant system through the heater core.

During the heating mode with the outside ambient temperature below 40°F the HTCM monitors refrigerant temperature coming out of the condenser if the refrigerant temperature gets too cold, the system will shut off the reversing valve will move and the system will actually go into the cooling mode, this is called the De-FEX mode. The cabin blower fan will turn off and remain off until the De-FEX cycle is complete, which takes 3-5 minutes. This mode is necessary in order to keep the front end heat exchanger (condenser) from freezing during the heat mode. The heat pump system will do this automatically when the system senses the condenser is too cold to operate correctly in the heat mode. Once the heat pump system starts the De-FEX cycle it can not be turned off and will have to complete the 3-5 minute cycle time.

The heat pump system is controlled by a heat pump ventilation/thermal control module (HTCM) that looks at the exterior ambient and the power level requested from the run/lock shift assembly controls. The HTCM will then command a certain amount of voltage to the compressor to maintain comfort in the cabin and optimize driving range. The first three minutes of the selected temperature range the compressor will run at a higher voltage to get the cabin temperature cooler or warmer depending on the mode selected. Then the voltage will be commanded to a lower steady state to optimize driving range while maintaining comfort.



HEAT PUMP VENTILATION SYSTEM



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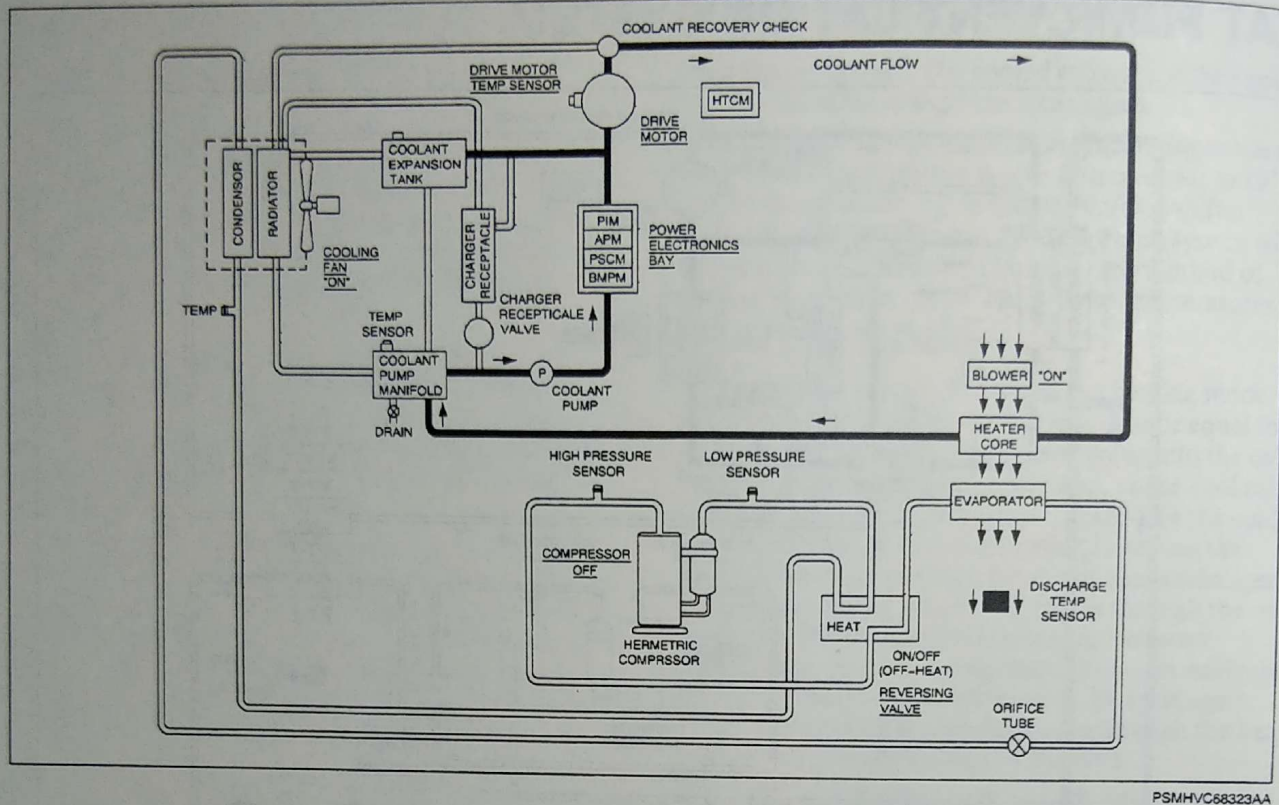
HEAT PUMP VENTILATION THERMAL CONTROL SYSTEM

"COOL MODE" FOR AMBIENT TEMPERATURES GREATER THAN 19°C (66°F) (HEAT PUMP ACTIVE)

SYSTEM OPERATION

The interior is cooled by the heat pump when any of the three "COOL MODES" are selected on the run/lock shifter assembly (RSA) and the outside ambient temperature is greater than 19°C (66°F). As illustrated in the above diagram in a solid line, coolant does not flow through the heater core because the coolant recovery check valve diverts the coolant from the propulsion system to the radiator. Refrigerant flow is indicated by the striped line in the above diagram. When refrigerant is pumped in this direction, the cabin heat exchanger inside the car is used as an evaporator to cool the interior. The front end heat exchanger is used as a condenser to remove heat build up in the refrigerant similar to current automotive air conditioning system. When "RECIRC" is On in cool mode and heated windshield is selected on the RSA, the system will change to outside air to inhibit condensation build up on the inside of the glass. If cool mode is selected below 19°C (66°F), the LEDs on the RSA will come On and the heat pump will remain inactive.

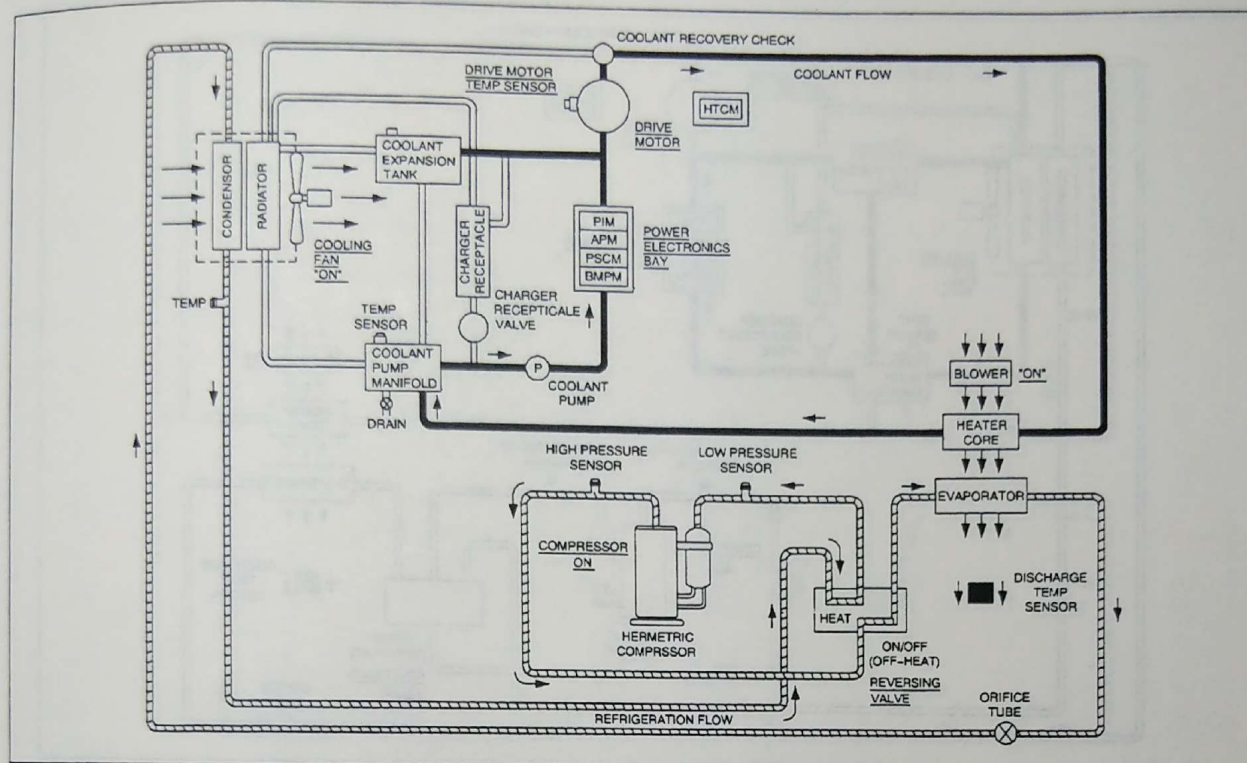




"HEAT MODE" FOR AMBIENT TEMPERATURES GREATER THAN 19°C (66°F) (HEAT PUMP INACTIVE)

SYSTEM OPERATION

The interior is heated by coolant through the heater core when any of the "HEAT MODES" are selected on the run/lock shifter assembly and the outside temperature is greater than 19°C (66°F). As illustrated in the above diagram in a solid line, coolant flows through the heater core because the coolant recovery check valve diverts the coolant from the propulsion system to the heater core. The heat pump system will be inactive when heat mode is selected above 19°C (66°F).



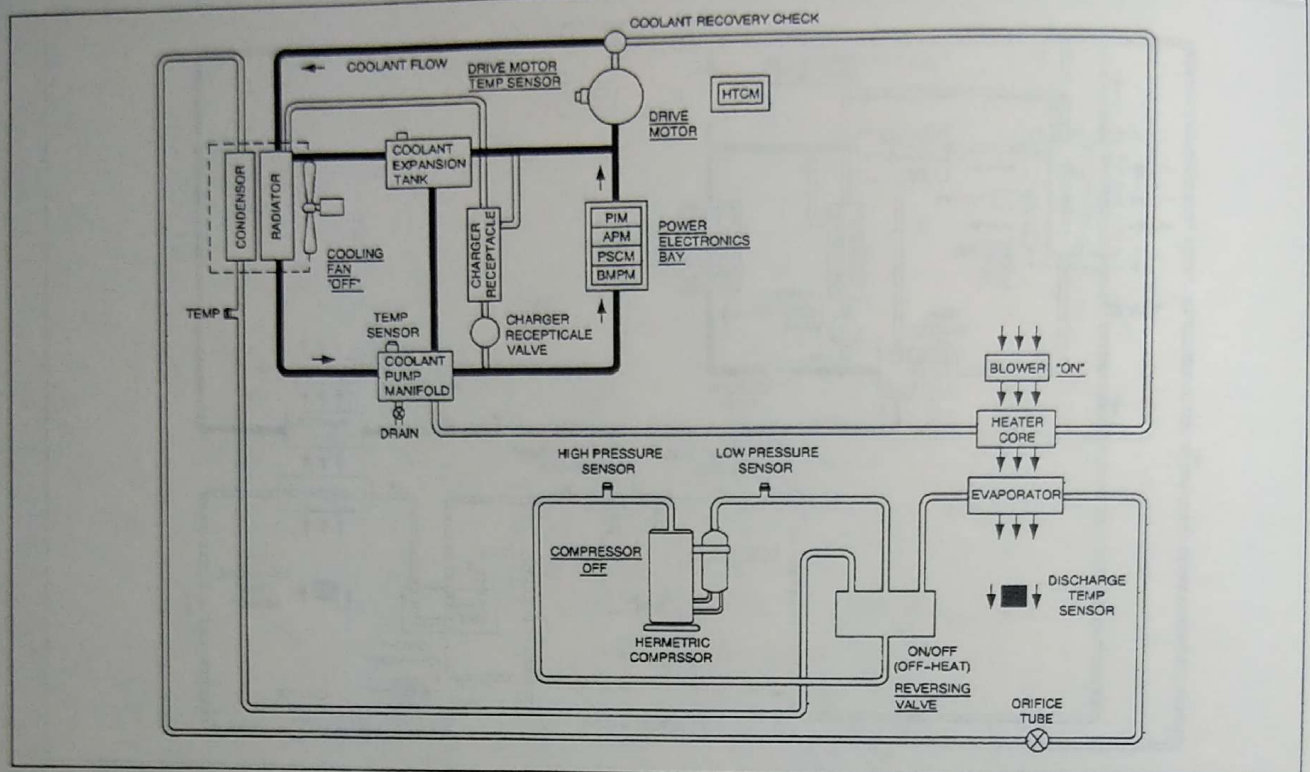
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"HEAT MODE" FOR AMBIENT TEMPERATURES EQUAL TO OR LESS THAN 19°C (66°F) (HEAT PUMP ACTIVE)

SYSTEM OPERATION

The interior is heated by coolant through the heater core and heat pump active when any of the "HEAT MODES" are selected on the run/lock shifter assembly and the outside temperature is less than or equal to 19°C (66°F). As illustrated in the above diagram in a solid line, coolant flows through the heater core because the coolant recovery check valve diverts the coolant from the propulsion system to the heater core. Refrigerant flow is indicated by the striped line in the above diagram. When refrigerant is pumped in this direction, the cabin heat exchanger is used as a condenser to warm the interior. The front end heat exchanger is used as an evaporator. When "RECIRC" is On in heat mode and heated windshield is selected On the RSA, the system will change to outside air to inhibit condensation build up on the inside of the glass.



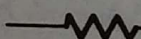


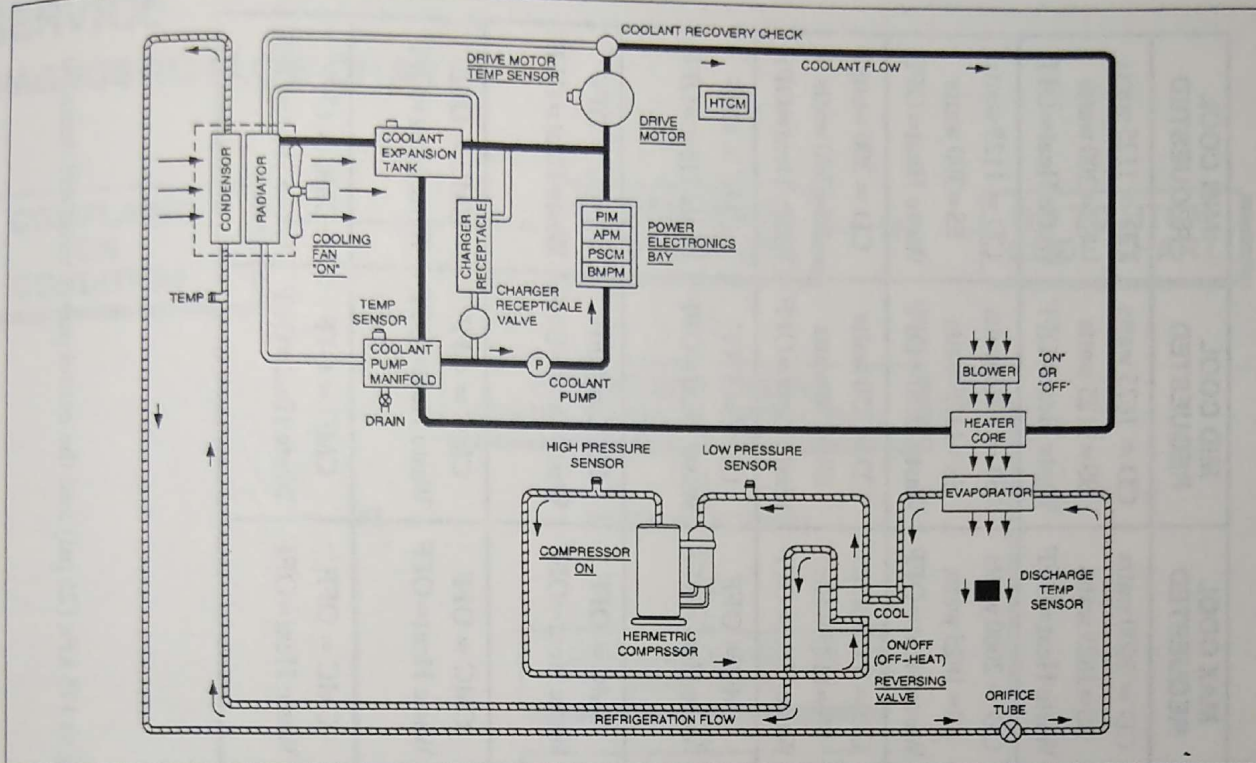
PSMHVC68319AA

"VENT MODE" FOR ALL TEMPERATURE RANGES (HEAT PUMP INACTIVE)

SYSTEM OPERATION

The interior is ventilated with outside air when "VENT MODE" is selected on the run/lock shifter assembly during all temperatures. As illustrated in the above diagram in a solid line, coolant flows through the radiator because the coolant recovery check valve diverts the coolant from the propulsion system to the radiator. The heat pump system will be inactive when vent mode is selected. Vent mode is the only way to cool the interior when the outside temperature is equal to or less than 19°C (66°F).





PSMHV/C68322AA

"DE-FEX CYCLE" WHEN IN "HEAT MODE" (HEAT PUMP ACTIVE)

SYSTEM OPERATION

The De-Fex cycle may occur when the heat pump system is operating in heat mode and the outside temperature is below 5°C (40°F). The purpose of De-Fex is to defrost the front end heat exchanger (condenser). When in De-Fex, the reversing valve will change to cool mode, reversing the flow of refrigerant and warming the front end heat exchanger, the heat pump will operate in cool mode for three to five minutes. During this time, the blower motor will turn Off and coolant will continue to flow through the heater core. When De-Fex has completed the cycle, the reversing valve will go back to heat mode and blower motor speed will resume to the previous settings. The De-Fex cycle will occur when the refrigerant temperature is very cold which could cause poor heating performance. Once the De-Fex cycle has started it can't be over ridden by turning the heat pump system Off, the system will continue to run until De-Fex cycle is complete.



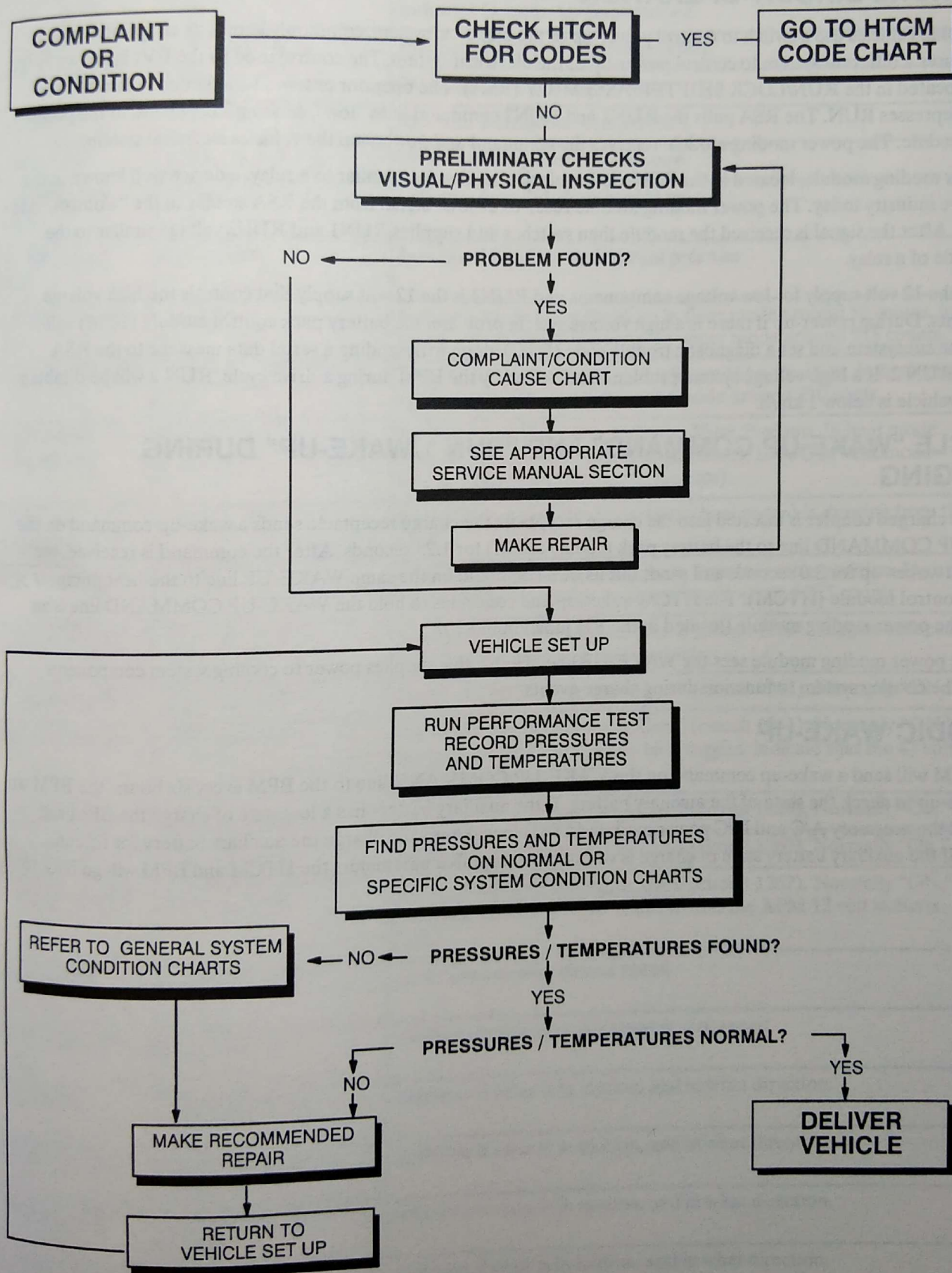
EV1 CABIN HEATING / COOLING POWER OPERATION MATRIX

AMBIENT TEMPERATURE	MAX HEAT REQUESTED	MID HEAT REQUESTED	MIN HEAT REQUESTED	VENT REQUESTED	MAX COOL REQUESTED	MID COOL REQUESTED	MIN COOL REQUESTED
> 35°C (95°F)	CMC = OFF Waste Heat=ON	CMC = OFF Waste Heat=ON	CMC = OFF Waste Heat=ON	CMC = OFF Waste Heat=OFF	CD = 2000 watts SS=1625 watts Waste Heat=OFF	CD = 1625 watts SS=1125 watts Waste Heat=OFF	CD = 1125 watts SS=300 watts Waste Heat=OFF
≤ 35°C (95°F) > 29°C (84°F)	CMC = OFF Waste Heat=ON	CMC = OFF Waste Heat=ON	CMC = OFF Waste Heat=ON	CMC = OFF Waste Heat=OFF	CD = 2000 watts SS=1625 watts Waste Heat=OFF	CD = 1625 watts SS=1125 watts Waste Heat=OFF	CD = 1125 watts SS=300 watts Waste Heat=OFF
≤ 29°C (84°F) > 19°C (66°F)	CMC = OFF Waste Heat=ON	CMC = OFF Waste Heat=ON	CMC = OFF Waste Heat=ON	CMC = OFF Waste Heat=OFF	CD = 1125 watts SS=1125 watts Waste Heat=OFF	CD = 750 watts SS=750 watts Waste Heat=OFF	CD = 300 watts SS=300 watts Waste Heat=OFF
≤ 19°C (66°F) > 05°C (41°F)	WU=1125 watts SS=700 watts Waste Heat=ON	WU=700 watts SS=500 watts Waste Heat=ON	WU=500 watts SS=300 watts Waste Heat=ON	CMC = OFF Waste Heat=OFF	CMC = OFF Waste Heat=OFF	CMC = OFF Waste Heat=OFF	CMC = OFF Waste Heat=OFF
≤ 05°C (41°F) > 01°C (34°F)	WU=1125 watts SS=1125 watts Waste Heat=ON	WU=1125 watts SS=700 watts Waste Heat=ON	WU=700 watts SS=300 watts Waste Heat=ON	CMC = OFF Waste Heat=OFF	CMC = OFF Waste Heat=OFF	CMC = OFF Waste Heat=OFF	CMC = OFF Waste Heat=OFF
≤ 01°C (34°F) > -4°C (25°F)	WU=1800 watts SS=1125 watts Waste Heat=ON	WU=1625 watts SS=800 watts Waste Heat=ON	WU=1125 watts SS=500 watts Waste Heat=ON	CMC = OFF Waste Heat=OFF	CMC = OFF Waste Heat=OFF	CMC = OFF Waste Heat=OFF	CMC = OFF Waste Heat=OFF
≤ -4°C (25°F)	WU=1125 watts SS=700 watts Waste Heat=ON	WU=1125 watts SS=700 watts Waste Heat=ON	WU=1125 watts SS=700 watts Waste Heat=ON	CMC = OFF Waste Heat=OFF	CMC = OFF Waste Heat=OFF	CMC = OFF Waste Heat=OFF	CMC = OFF Waste Heat=OFF

WU = Warm Up
SS = Steady State
CD = Cool Down

Watts shown are the maximum HTCM command. The compressor will enter lowside pressure limiting at 175 kPa (25 psi) and the actual power used will decrease. To determine the wattage value multiply CMC DC current by Pack Voltage.

SERVICE DIAGNOSTIC FLOW CHART



POWER DISTRIBUTION

SYSTEM OPERATION

RUN1/RUN2 CIRCUIT OPERATION

Conventional vehicles use a switch to control power-up of the electrical system, commonly known as an ignition switch. The EV1 uses a different system to control power-up of the electrical system. The control used by the EV1 is known as the key pad, located in the RUN/LOCK SHIFTER ASSEMBLY (RSA). The operator enters a valid key code into the key pad and depresses RUN. The RSA pulls the RUN1 and RUN2 command lines "low", sending a command to the power moding module. The power moding module receives the command and powers-up the vehicles electrical system.

The power moding module, located in the RH junction block operates very similar to a relay, a device well known in the automotive industry today. The power moding module receives a "low" signal from the RSA similar to the "Control" side of a relay. After the signal is received the module then switches and supplies RUN1 and RUN2 voltage similar to the "Load" side of a relay.

RUN1 is the 12 volt supply for low voltage components and RUN2 is the 12 volt supply that controls the high voltage components. During power-up if there is a high voltage system problem, the battery pack control module (BPM) will identify the subsystem and set a diagnostic trouble code (DTC) along with sending a serial data message to the RSA disabling RUN 2. If a high voltage system problem is identified by the BPM during a drive cycle, RUN 2 will be disabled after the vehicle is below 1 km/h.

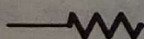
VEHICLE "WAKE-UP COMMAND" AND "RUN 1/WAKE-UP" DURING CHARGING

When the charged coupler is inserted into the charge receptacle the charge receptacle sends a wake-up command on the WAKE-UP COMMAND line to the battery pack module (BPM) for 1.25 seconds. After the command is received, the BPM then wakes-up for 3.0 seconds and sends out its own command on the same WAKE-UP line to the heat pump thermal control module (HTCM). The HTCM wakes-up and continues to hold the WAKE-UP COMMAND line is an input to the power moding module (located in the RH junction block).

When the power moding module sees the WAKE-UP line "High", this supplies power to cooling system components allowing the cooling system to function during charge events.

PERIODIC WAKE-UP

The HTCM will send a wake-up command on the WAKE-UP COMMAND line to the BPM every six hours, the BPM will then wake-up to check the state of the auxiliary battery. If the auxiliary battery has a low state of charge the BPM will command the accessory A/C and D/C power module (APM) to wake-up and charge the auxiliary battery for fifteen minutes. If the auxiliary battery state of charge is within the acceptable parameters the HTCM and BPM will go back to sleep.



HTCM SCAN TOOL INFORMATION**GENERAL INFORMATION**

PARAMETER	SCAN TOOL DISPLAY	DEFINITION
OSA TEMP	-40°C to +60°C	Indicates Outside Air Temperature
DSCHRG	-40°C to +85°C	Indicates Discharge Air Temperature
COOLANT	-20°C to +100°C	Indicates Coolant Temperature
REFRIG	-40°C to +100°C	Indicates Refrigerant Temperature
DRV UNIT	-20°C to +100°C	Indicates Drive Unit Temperature
LO SIDE A/C KPA	0-695 kPa	Indicates Low Side Refrigerant pressure
HI SIDE A/C KPA	0-3185 kPa	Indicates High Side Refrigerant pressure
MODE DOOR FB	0-255	Indicates Mode Door Position. In floor mode around 50 counts, in split mode around 100 counts, In upper mode around 215 counts.
OSA VALVE FB	0-255	Outside Air Valve Feedback. Indicates Valve Position. In fresh air mode around 30 counts, In recirc mode around 210 counts.
COOLANT VALVE FB	0-255	Coolant Valve Feedback. Indicates Valve Position. In heat mode around 40 counts (coolant to heater core), In A/C or vent mode around 255 counts (coolant to radiator).
CMC DC CURRENT	0.0-8.0 amps	Amount of current the compressor (heat pump) is drawing from the CMC.
CR VALVE FB	0-255	Charge Receptacle valve feedback. Indicates valve position. In run mode around 40 counts. In charge mode around 255 counts.
CMC/47V BIT 2	"ON" or "OFF"	Status of CMC/47 volt status line 2 (circuit 1063). Toggles between "ON" and "OFF" once each second.
CMC/47V BIT 1	"ON" or "OFF"	Status of CMC/47 volt status line 1 (circuit 1062). Normally "ON."
CMC/47V BIT 0	"ON" or "OFF"	Status of CMC/47 volt status line 0 (circuit 1061). Normally "ON." Status bits 0 and 1 ON, while bit 2 toggles, indicate that the 47 volt and CMC status are O.K.
APM 12V BIT 2	"ON" or "OFF"	Status of APM 12 volt status line 2 (circuit 1264). Normally "On."
APM 12V BIT 1	"ON" or "OFF"	Status of APM 12 volt status line 1 (circuit 1263). Normally "On."
APM 12V BIT 0	"ON" or "OFF"	Status of APM 12 volt status line 0 (circuit 1262). Normally "ON." All three status bits "ON" indicate that the APM 12 volt status is O.K.
CMD BLWR SPD %	0-100%	Commanded cabin blower speed
CMC CMD SPD (HZ)	0-132 HZ	Commanded compressor (heat pump) speed
CR VALVE	"CW", "CCW" or "STOP"	Indicates if valve is in motion, and in what direction.
COOL VALVE	"CW", "CCW" or "STOP"	Indicates if valve is in motion, and in what direction.
OSA VALVE	"CW", "CCW" or "STOP"	Indicates if valve is in motion, and in what direction.
MODE DOOR	"CW", "CCW" or "STOP"	Indicates if door is in motion, and in what direction.

HTCM SCAN TOOL INFORMATION

GENERAL INFORMATION

PARAMETER	SCAN TOOL DISPLAY	DEFINITION
BRAKE LOADSHED	"YES" or "NO"	Indicates if a loadshed is occurring.
RUN 1	"ON" or "OFF"	Indicates if Run 1 is present.
WAKEUP LINE	"YES" or "NO"	Indicates if the wakeup signal is present.
COOLANT LEVEL OK	"YES" or "NO"	Indicates if coolant level is O.K.
REAR DEFOG CMD	"ON" or "OFF"	Rear window defog command status.
WINDSHIELD CMD	"ON" or "OFF"	Windshield defog/de-ice command status.
REV VALVE CMD	"ON" or "OFF"	Reversing valve command status.
COOL PUMP SPD %	0-100%	Coolant pump commanded speed. Normally 20% in charge mode, 71% in run mode.
FRONT END FAN %	0-100%	Front end fan commanded speed.
OP STATE	"PRECOND", "CHARGE", "DRIVE", "PERIOD W-UP"	Operating state. "CHARGE" while charging, "DRIVE" in Run mode (with paddle not in receptacle), "PERIOD W-UP" if in periodic wakeup state, "PRECOND" if preconditioning is currently taking place.
CMC GROUND VLT	0-5 volts	Indicates case sense voltage detected. Normally 0.0 volts.
PS GROUND VLT	0-5 volts	Indicates case sense voltage detected. Normally 0.0 volts.

CURRENT CODES

T-CODE/FLAG	"YES" or "NO"	Yes if any current DTCs are present.
-------------	---------------	--------------------------------------

HISTORY CODES

T-CODE/FLAG	"YES" or "NO"	Yes if any history DTCs are present.
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SYSTEM ID

ROM ID	XXXXXXXX	
CAL ID	XXXXXXXX	

PRELIMINARY CHECKS

Most A/C system problems can be detected by a thorough visual and physical inspection of the system and its components.

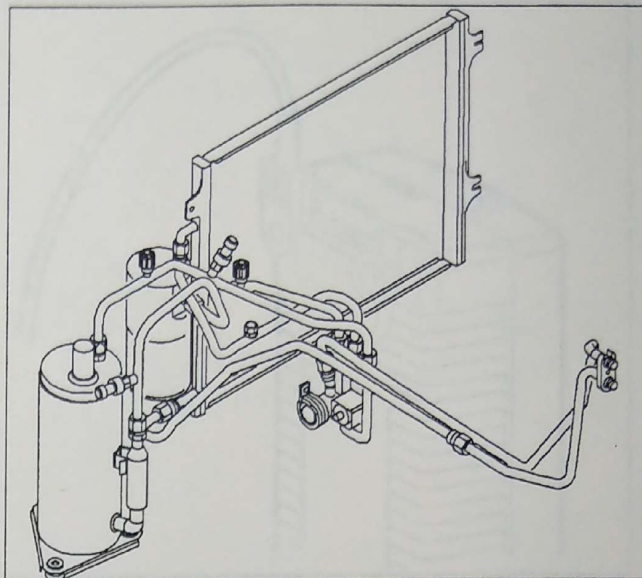
1. Check for all diagnostic trouble codes (DTCs). If DTC(s) are present, refer to the Diagnostic Chart for that DTC.

CAUTION: IF HTCM – DTC-025 OR ANY OTHER DTCS ARE SET, REFER TO THE DIAGNOSTIC CHARTS FOR THOSE DTCS BEFORE PROCEEDING FURTHER. FAILURE TO FOLLOW THIS CAUTION COULD RESULT IN PERSONAL INJURY OR VEHICLE DAMAGE.

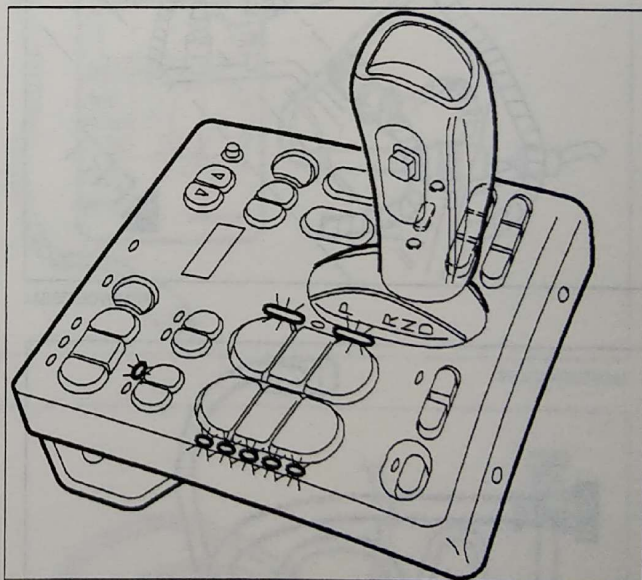
2. Check the air inlet duct, side air deflectors, condenser to radiator seals, and rear hood seal for missing or damaged parts.

IMPORTANT: The importance of this check cannot be stressed enough because proper heating and cooling depends upon adequate front air flow.

3. Check outer surfaces of radiator and condenser cores to be sure air flow is not blocked by dirt, leaves or other foreign material.
4. Check for kinks in lines. Also check for refrigerant leaks using an electronic leak detector.
5. Check blower motor operation at all five speeds.
6. With blower on high, check for equal distribution of air out of all outlets.
7. Check operation of mode door control and the distribution of air from the designated outlets. (The PDT may be used to monitor mode door feedback.)
8. Depress Recirc button with blower on High. A noticeable increase in air flow and sound should occur. Indicator should light. (The PDT may be used to monitor recirc door feedback.)
9. With vehicle in Run mode, operate A/C system until it is up to operating temperature.
10. Check electric cooling fan operation with A/C On.
11. Check operation of compressor. (Refer to "Heat Pump Compressor Test" found in this service manual.)



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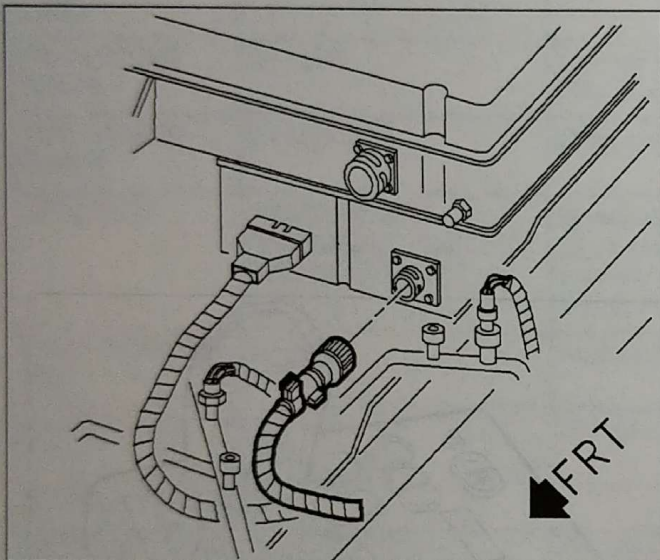


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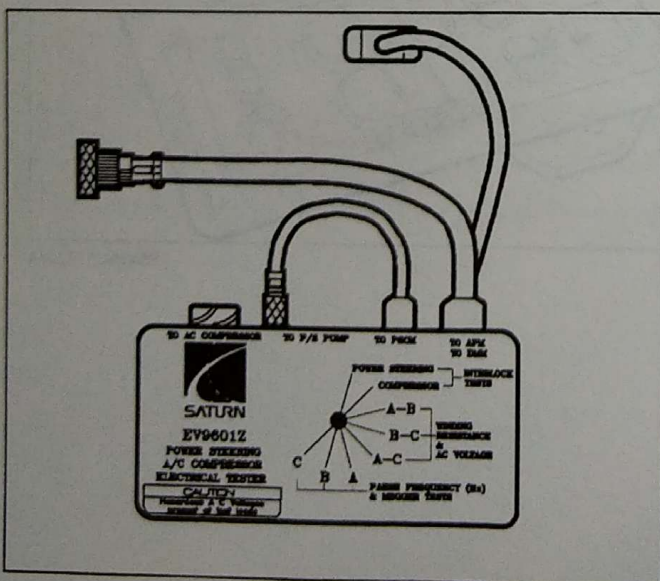
TEST 1 – HEAT PUMP COMPRESSOR INSULATION/MEGGER TEST

CAUTION: TO REDUCE THE RISK OF SEVERE SHOCKS AND BURNS, THE HIGH VOLTAGE SYSTEM SHOULD BE DISABLED ANY TIME SERVICE WORK IS BEING PERFORMED ON OR AROUND THE HIGH VOLTAGE SYSTEM. WHEN IN DOUBT, ALWAYS DISABLE THE HIGH VOLTAGE SYSTEM. THE 12 VOLT SYSTEM WILL STILL BE ACTIVE AFTER THE HIGH VOLTAGE SYSTEM HAS BEEN DISABLED.

1. Place key pad in the **LOCK** mode.
2. If high voltage system has been disabled, proceed to step 3. If the high voltage system has not been disabled, refer to "High Voltage Disable" procedure in this manual and disable the high voltage system.
3. Disconnect heat pump compressor wire harness cannon connector from the accessory power module (APM).



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4. Install wire harness cannon connector from compressor into EV9701Z (power steering – A/C compressor electrical tester).

IMPORTANT: Do not connect wire harness connector from EV9701Z (power steering – A/C compressor electrical tester) into APM connector at this time.

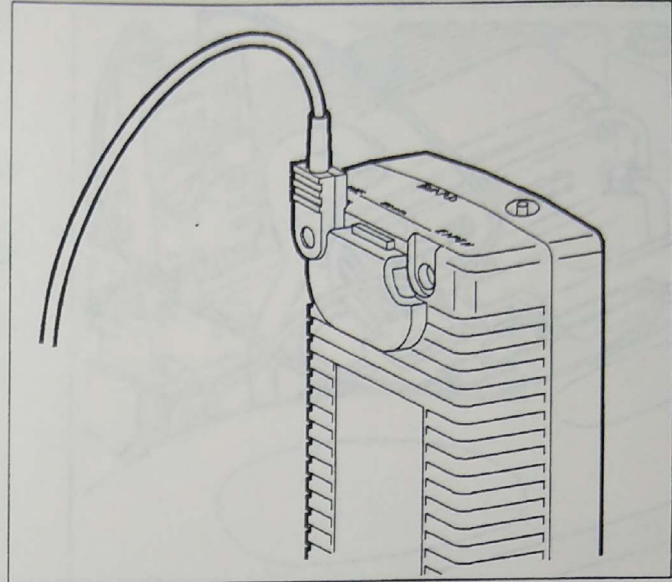
IMPORTANT: Connect power steering lead from EV9701Z into P/S connector on tester. Failure to do this will lead to inaccurate results.

5. Select a MEGGER switch position on EV9701Z (power steering – A/C compressor electrical tester).

IMPORTANT: Megger tests can be performed at either of the switch points A, B or C.

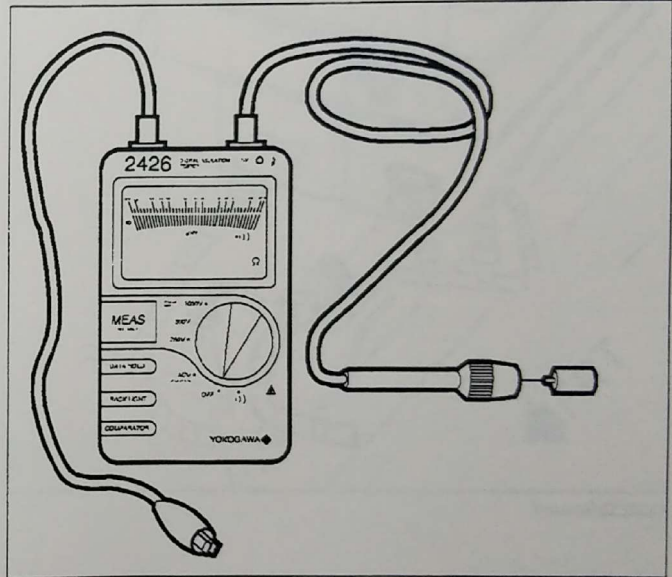
6. Install EV9735Z (Digital Insulation Tester/Megger) test leads into the back of tester.
7. Install black wire to EARTH (ground). Orange wire to LINE (line probe).

IMPORTANT: Make sure the leads are fully seated into tester.



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8. Make sure that the DVOM plug adaptor is attached to the line probe (orange wire) on the EV9735Z (Digital Insulation Tester) and connect to the red side of the EV9701Z (power steering – A/C compressor electrical tester) DVOM connector.

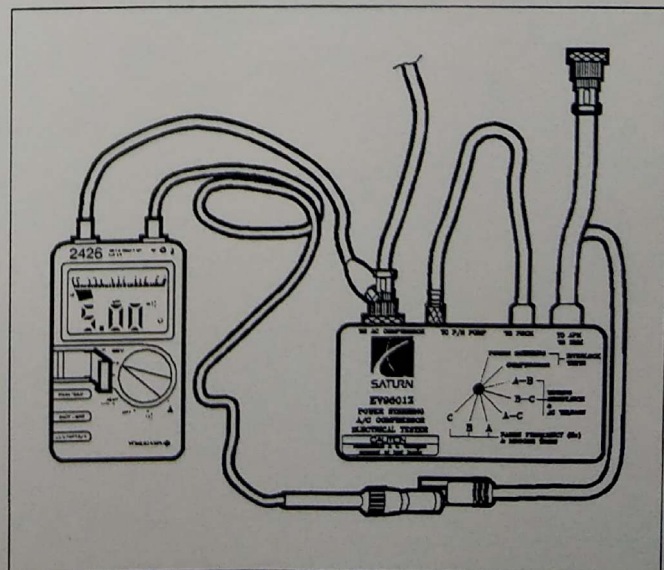


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9. Connect the EARTH ground (black wire) from the tester to the heat pump compressor wire harness cannon connector body.
10. Set EV9735Z (Digital Insulation Tester) to the 500 volt range.

CAUTION: TO PREVENT SHOCK OR BURNS, ALWAYS HAVE METER HOOKED UP AND IN POSITION TO TAKE MEASUREMENTS. IF NOT, MAKE SURE THE PROBE END IS NOT TOUCHING ANYTHING. AS SOON AS THE METER MEASURE HANDLE IS LIFTED, THERE IS VOLTAGE POTENTIAL ACROSS THE METER.

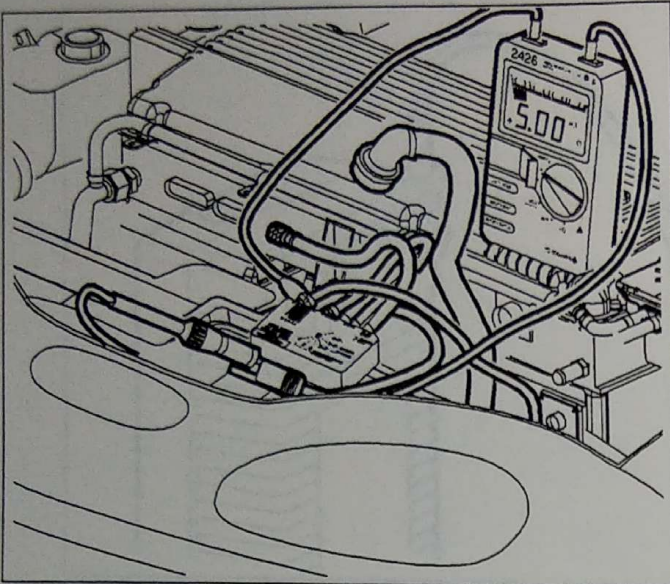
11. Lift the meter measure handle on EV9734Z (Digital Insulation Tester). Notice the High Voltage LED is on in the right – top corner. This indicates high voltage is present on the tool.



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HVAC 61



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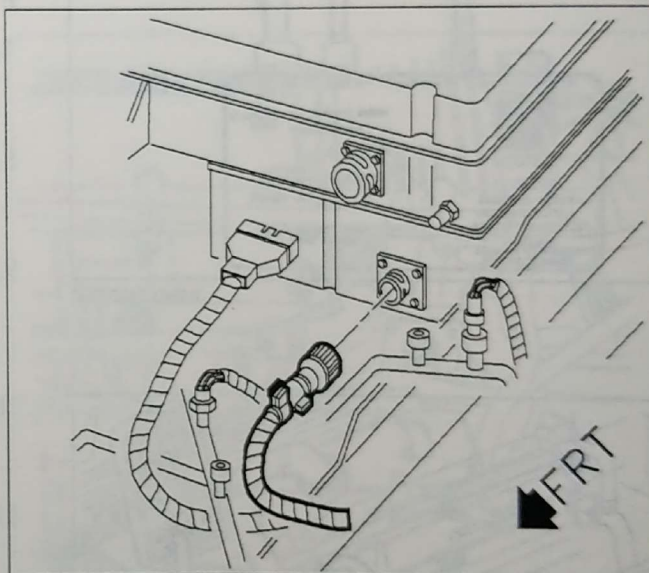
12. With the meter measure handle lifted, view/record measurement on tester.
13. Reading should be between $5.0\text{ M}\Omega$ (5.0 MEG—OHMS) and infinity (OL).
14. If reading is not within the range listed in step 13, replace heat pump compressor motor assembly.
15. If reading falls within the range listed in step 13, refer to "Test 2 – Heat Pump Compressor Electrical Test in this manual.



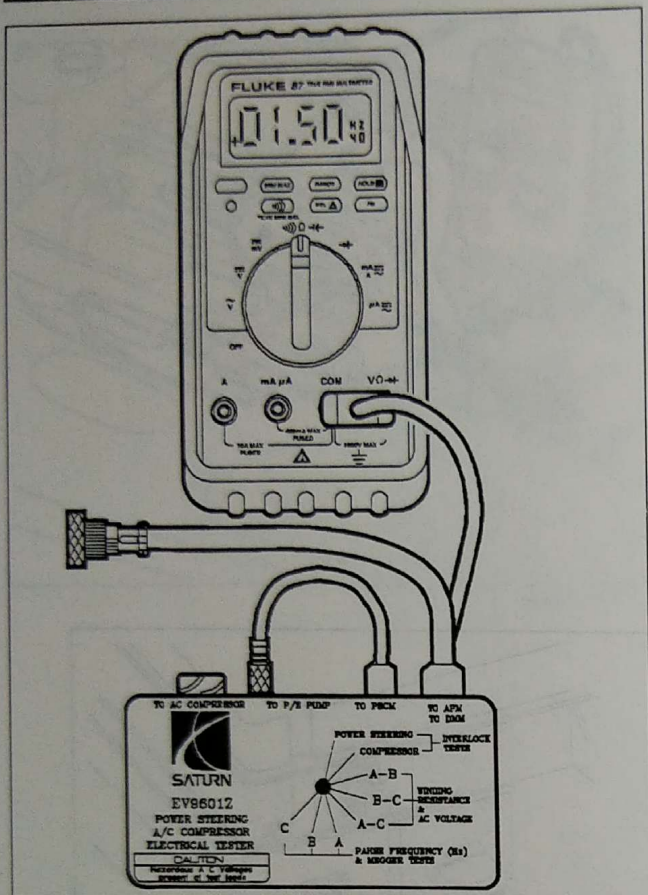
TEST 2 – HEAT PUMP COMPRESSOR ELECTRICAL TEST

CAUTION: TO REDUCE THE RISK OF SEVERE SHOCKS AND BURNS, THE HIGH VOLTAGE SYSTEM SHOULD BE DISABLED ANY TIME SERVICE WORK IS BEING PERFORMED ON OR AROUND THE HIGH VOLTAGE SYSTEM. WHEN IN DOUBT, ALWAYS DISABLE THE HIGH VOLTAGE SYSTEM. THE 12 VOLT SYSTEM WILL STILL BE ACTIVE AFTER THE HIGH VOLTAGE SYSTEM HAS BEEN DISABLED.

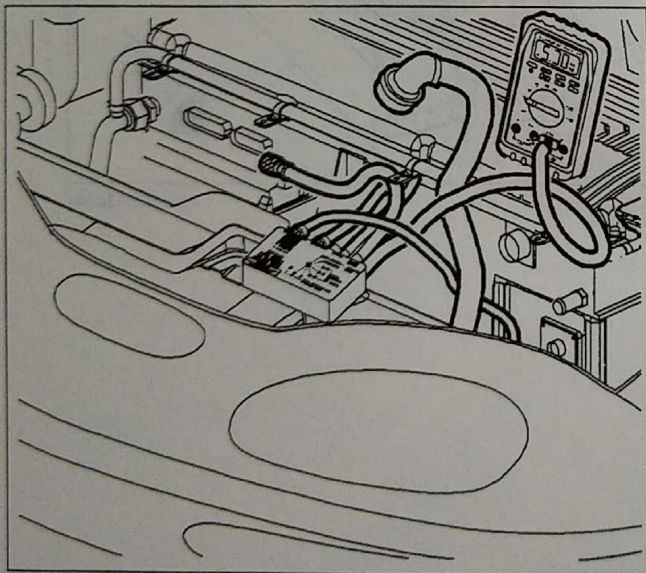
1. Place key pad in the **LOCK** mode.
2. If high voltage system has been disabled, proceed to step 3. If high voltage has not been disabled, refer to "High Voltage Disable" procedure in this manual and disable high voltage system.
3. Disconnect heat pump compressor wire harness cannon connector from the accessory power module (APM).



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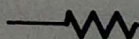
4. Install wire harness connector from compressor motor into EV9701Z (power steering – A/C compressor electrical tester).
5. Connect digital multimeter (DVOM) lead from EV9701Z into DVOM.

IMPORTANT: Do not connect wire harness connector from EV9701Z (power steering – A/C compressor electrical tester) into APM connector at this time.

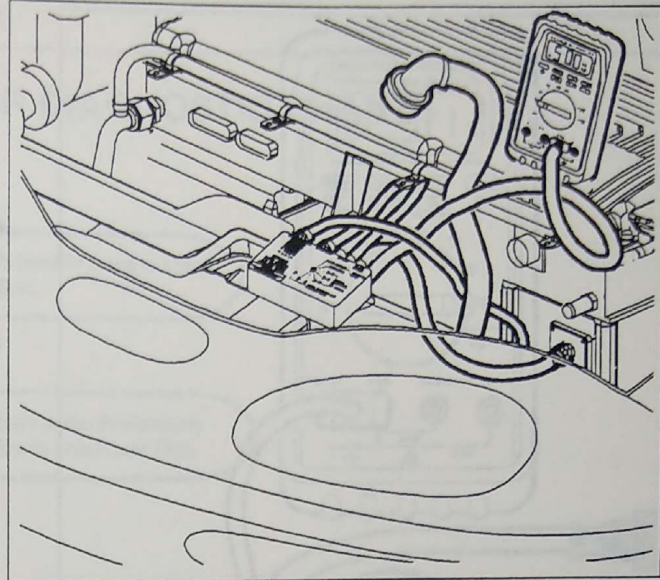
IMPORTANT: Connect power steering lead from EV9701Z into P/S connector on tester. Failure to do this will lead to inaccurate results.

NOTICE: When using a multimeter on the ohmmeter scale, make sure the circuit or component is disconnected from the power source. Applying voltage to a multimeter when you are measuring resistance can damage the multimeter.

6. Set DVOM to the ohmmeter setting.
7. Measure compressor motor winding resistance at switch points A–B, B–C, A–C and COMPRESSOR INTER-LOCK.
8. Resistance at switch points A–B, B–C, and A–C should be between 0.8 - 2.0 ohms at normal/typical operating temperature.
9. Resistance at switch point COMPRESSOR INTER-LOCK should be less than 1.0 ohm at normal/typical operating temperature of 50°C (120°F).
10. If resistance readings do not fall within range listed in steps 8 and 9, replace heat pump compressor motor.
11. If resistance readings fall within the range listed in steps 8 and 9, go to step 12.



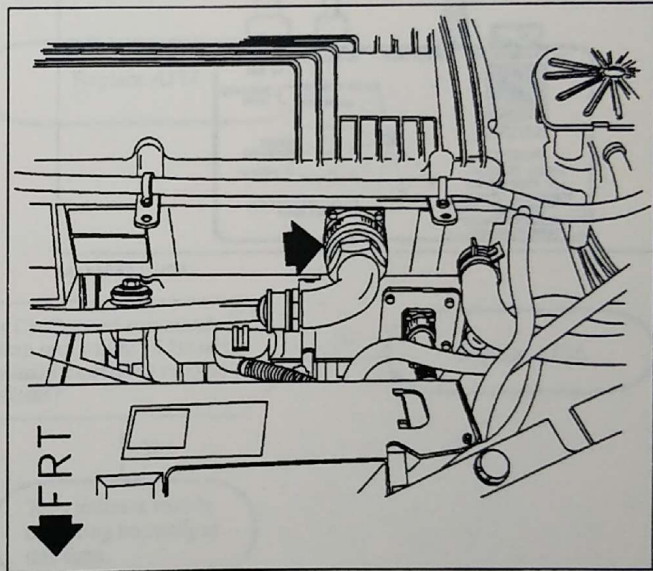
12. Install wire harness from EV9701Z (power steering - A/C compressor electrical tester) to the APM compressor cannon connector.
13. Set DVOM to the A/C voltage setting.



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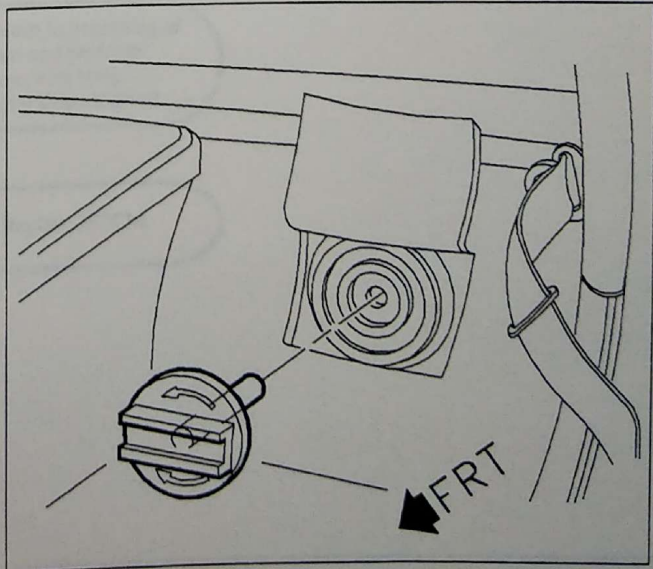
IMPORTANT: Do not use any tools to reinstall the connector. Excessive force or misalignment can damage the connector.

14. Reinstall the charge receptacle to PIM connector.



PSMPEN65997AA

15. Install the manual disconnect handle by pushing the shaft straight into the hole and turning clockwise.
16. Power vehicle up and clear BPM DTCs. If the vehicle does not power-up, refer to the "High Voltage" section of the Battery and Charging System service manual.



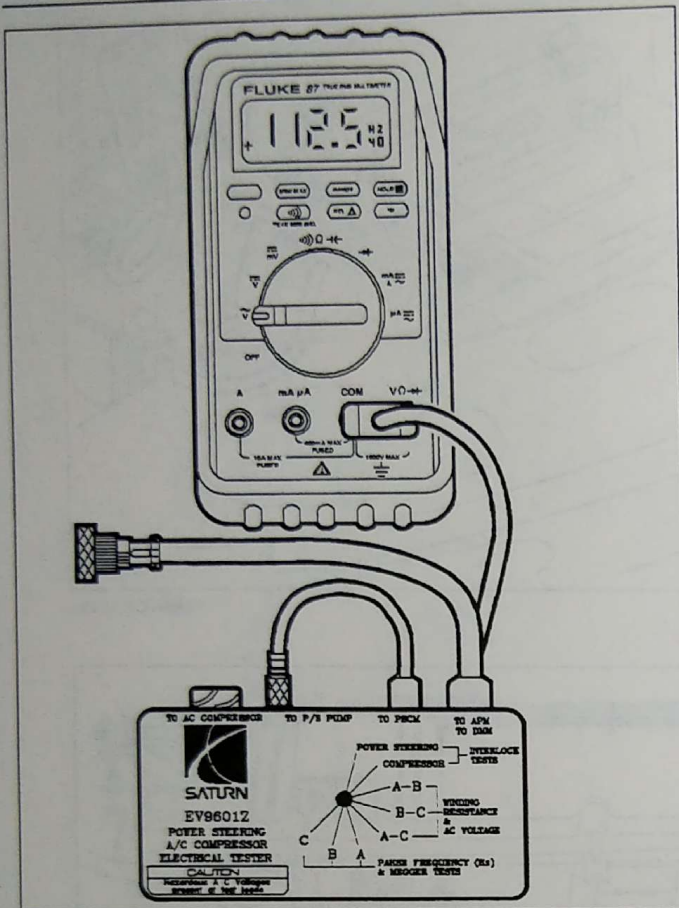
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17. Remove charge coupler if installed. Turn heat pump system to high (maximum heat if ambient temperature is below 19°C [66°F], maximum cool if ambient temperature is above 19°C [66°F]). Wait five minutes before taking any readings. This is necessary to allow system to stabilize.

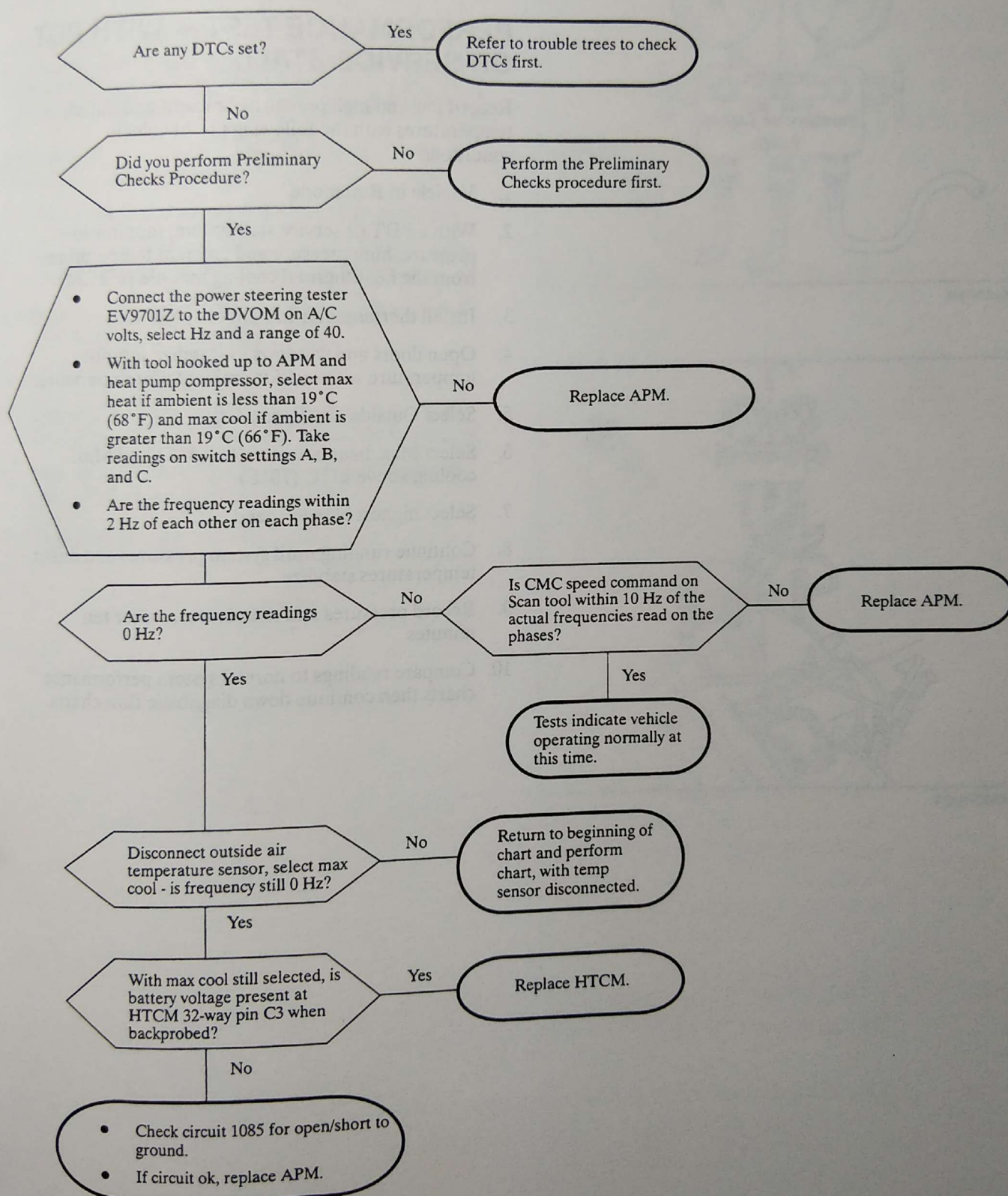
CAUTION: THE EV9701Z POWER STEERING - A/C COMPRESSOR ELECTRICAL TESTER, LEADS AND DVOM MAY NOW CONTAIN UP TO 230 VOLTS A/C.

18. Measure A/C voltage at switch points A-B, B-C and A-C.
19. A/C voltage at switch points A-B, B-C, A-C should be within 10 volts A/C of each other. If they are not, replace the APM.



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HEAT PUMP COMPRESSOR DIAGNOSTIC CHARTS



VEHICLE SET-UP

If an A/C system problem still exists after you have completed the preliminary checks, more diagnostics must follow. This includes the proper set-up on the vehicle prior to vehicle testing.

PERFORMANCE TEST – WITH PDT OR SERVICE STALL

Record low and high pressures, ambient and outlet temperatures with the following preset vehicle conditions:

1. Vehicle in Run mode.
2. With a PDT or service stall system, monitor low pressure, high pressure and ambient temperature from the heat thermal cooling module (HTCM).
3. Install thermometer in right center outlet.
4. Open doors and windows to stabilize interior temperature with outside ambient air temperature.
5. Select Outside air (Recirc Off).
6. Select Max. heat below 19°C (65°F) and Max. cooling above 21°C (70°F).
7. Select highest blower speed.
8. Continue running until system pressures and outlet temperatures stabilize.
9. Record pressures and temperatures after ten minutes.
10. Compare readings to normal system performance charts then continue down diagnostic flow charts.



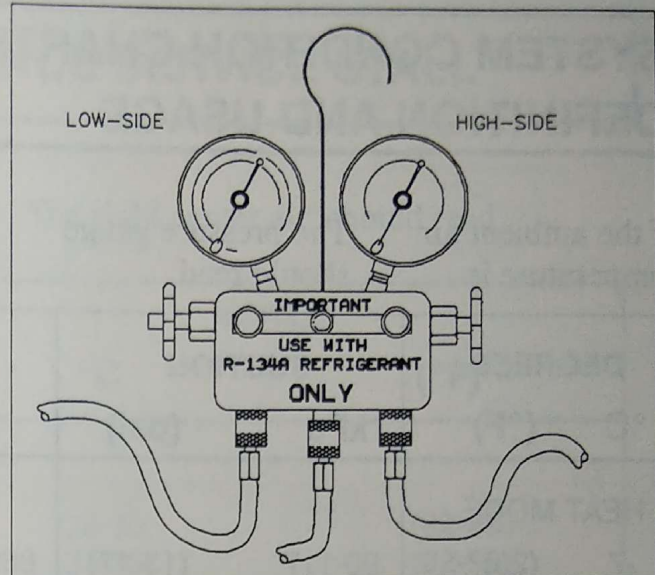
INSTALLING MANIFOLD GAUGE SET

If a PDT is not available or a pressure transducer is suspected of incorrect pressure readings, then the installation of a manifold gauge set will be necessary to perform the performance test. Follow the steps listed below for installing a manifold gauge set.

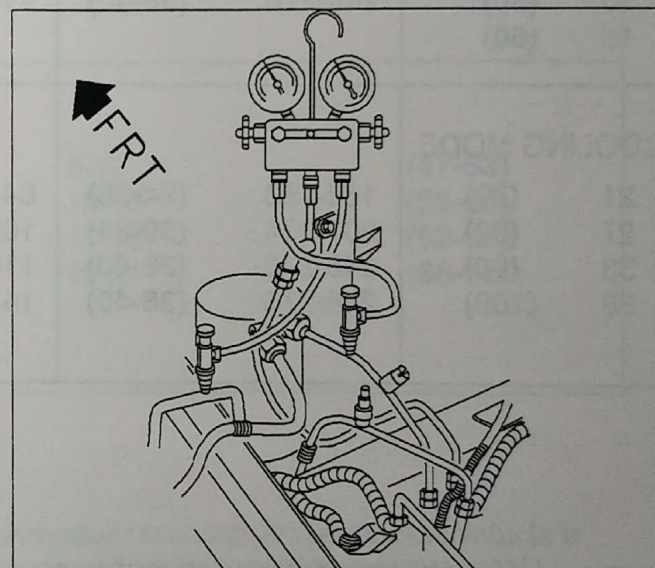
CAUTION: ALWAYS WEAR GOGGLES AND WRAP A CLEAN CLOTH AROUND FITTINGS, VALVES, AND CONNECTIONS WHEN PERFORMING WORK THAT INVOLVES OPENING THE REFRIGERANT SYSTEM.

IMPORTANT: Check to make sure gauges read zero before installing manifold gauge set.

1. Close both hand valves of the manifold gauge set.
2. Connect the low pressure (blue) gauge hose to the suction service port located on the suction pipe.
3. Pull valve assembly collar up, place valve assembly over service port and release collar.
4. Open service valve.
5. Connect the high pressure (red) gauge hose to the discharge service port located on the discharge pipe.
6. Pull valve assembly collar up, place valve assembly over service port and release collar.
7. Open service valve.



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SYSTEM CONDITION CHARTS DEFINITION AND USAGE

If the ambient air
temperature is . . .

The pressure gauge
should read . . .

The pressure gauge
should read . . .

The right center air
should read . . .

DEGREES		SUCTION		DISCHARGE		OUTLET	
°C	(°F)	kPa	(psi)	kPa	(psi)	°C	(°F)
HEAT MODE							
-7	(20)	90-117	(13-17)	869-896	(126-130)	28-30	(82-86)
-1	(30)	110-138	(16-20)	1034-1062	(150-154)	34-36	(92-96)
3	(38)	165-193	(24-28)	896-924	(130-134)	31-34	(88-92)
10	(50)	248-276	(36-40)	1165-1193	(169-173)	39-41	(101-106)
16	(60)						
COOLING MODE							
21	(70)	165-193	(24-28)	841-869	(122-126)	8-12	(47-53)
27	(80)	207-234	(30-34)	1020-1048	(148-152)	13-16	(56-60)
33	(90)	248-276	(36-40)	1165-1193	(169-173)	17-19	(62-66)
38	(100)	248-276	(36-40)	1482-1510	(215-219)	19-21	(66-70)

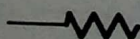
KEY:

STATEMENTS ARE USED TO INTERPRET THE PRESSURE AND TEMPERATURE READINGS COMPARED TO NORMAL SYSTEM PERFORMANCE. IF TESTING ABOVE OR BELOW AMBIENT TEMPERATURES LISTED, RELY ON KEY STATEMENTS TO DIAGNOSE SYSTEM.

THEN:

Statements contain additional information to help you confirm your diagnosis and lead you to a corrective action.

- When **all** pressure and temperature readings fall within the ranges of a given chart, use that chart to repair the vehicle.



NORMAL SYSTEM PERFORMANCE SERVICE STALL

If the ambient air temperature is . . .

The right center air should read . . .

DEGREES		OUTLET	
°C	(°F)	°C	(°F)
HEAT MODE			
-7	(20)	28-30	(82-86)
-1	(30)	34-36	(92-96)
3	(38)	31-34	(88-92)
10	(50)	39-41	(101-106)
16	(60)		
COOLING MODE			
21	(70)	8-12	(47-53)
27	(80)	13-16	(56-60)
33	(90)	17-19	(62-66)
38	(100)	19-21	(66-70)

IMPORTANT: To ensure accurate pressure and temperature readings make sure the vehicle is properly set up to run the performance test. (Refer to vehicle set up section in this manual).
All test parameters must be followed to obtain accurate readings.

Confirm system performance by touching the suction and discharge pipes at the compressor. The suction pipe will be cold and the discharge pipe will be hot.

At temperatures above 19°C (66°F), the HVAC system will allow A/C only. Below 19°C (66°F), the HVAC system will allow heat pump only.



NORMAL SYSTEM PERFORMANCE HIGH HUMIDITY

If the ambient air temperature is . . .

The right center air should read . . .

DEGREES		OUTLET	
°C	(°F)	°C	(°F)
HEAT MODE Not Applicable			
COOLING MODE			
21	(70)	10-13	(50-55)
27	(80)	16-18	(61-65)
33	(90)	22-25	(72-76)
38	(100)	28-30	(82-86)

- High humidity conditions affect system performance by increased heat load on the system. A relative humidity above 70 percent will be considered high humidity.
- This chart illustrates the effect high humidity has on the EV1 air conditioning and heat pump system. Use this chart to determine normal system performance under high humidity conditions.
- As a general rule normal systems operating under high humidity conditions will produce an outlet temperature of at least 15°F below ambient air temperature.
- At temperatures above 19°C (66°F), the HVAC system will allow A/C only. Below 19°C (66°F), the HVAC system will allow heat pump only.



GENERAL SYSTEM CONDITION - LOW REFRIGERANT CHARGE

If the ambient air
temperature is . . .

AND pressure
gauge reads . . .

AND pressure
gauge reads . . .

AND right center
air reads . . .

DEGREES		SUCTION		DISCHARGE		OUTLET	
°C	(°F)	kPa	(psi)	kPa	(psi)	°C	(°F)
HEAT MODE							
-7	(20)	-28-7	(-4-1)	434-462	(63-67)	13-16	(55-60)
-1	(30)	-28-7	(-4-1)	448-476	(65-69)	14-17	(57-62)
3	(38)	0-34	(0-5)	469-496	(68-72)	16-18	(60-65)
10	(50)	0-34	(0-5)	558-586	(81-85)	20-23	(68-73)
16	(60)						
COOLING MODE							
21	(70)	165-193	(24-28)	572-607	(83-88)	16-19	(61-66)
27	(80)	165-193	(24-28)	648-676	(94-98)	21-24	(70-75)
33	(90)	165-193	(24-28)	738-765	(107-111)	27-30	(81-86)
38	(100)	165-193	(24-28)	869-896	(126-130)	28-31	(82-87)

KEY: POOR COOLING AT HIGHER AMBIENTS.
POOR HEATING AT LOWER AMBIENT.

THEN: System is operating with a low charge.

- Confirm by touching the suction and discharge pipes at the compressor. Suction pipe will be cool to warm and discharge pipe will be warm to hot.
- Pipe temperatures will vary with ambient air temperature and the amount of charge lost. Suction and outlet temperatures will be warmer in air conditioning mode and cooler in heat pump mode as more refrigerant is lost.
- The pressures are not absolute and should be used as a guide in diagnosis.
- Leak test all components and connections.
- If refrigerant charge level is unknown, reclaim, evacuate, change valve cores and recharge system with 0.91 kg (2.0 lbs.) of R134-a.
- Run another performance test.



GENERAL SYSTEM CONDITION - LOW SIDE RESTRICTIONS

If the ambient air
temperature is . . .

AND pressure
gauge reads. . .

AND pressure
gauge reads . . .

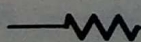
AND right center
air reads . . .

DEGREES		SUCTION		DISCHARGE		OUTLET	
°C	(°F)	kPa	(psi)	kPa	(psi)	°C	(°F)
HEAT MODE							
-7	(20)	83-117	(12-17)	855-883	(124-128)	27-30	(81-86)
-1	(30)	124-152	(18-22)	1069-1096	(155-159)	34-37	(93-98)
3	(38)	172-200	(25-29)	938-965	(136-140)	32-35	(90-95)
10	(50)	234-262	(34-38)	1083-1110	(157-161)	37-40	(98-103)
16	(60)						
COOLING MODE							
21	(70)	234-262	(34-38)	772-800	(112-116)	12-15	(53-58)
27	(80)	228-255	(33-37)	1014-1041	(147-151)	14-17	(57-62)
33	(90)	310-338	(45-49)	1076-1103	(156-160)	19-22	(66-71)
38	(100)	255-262	(37-42)	1289-1317	(187-191)	18-21	(65-70)

KEY: TEMPERATURE DROP ACROSS RESTRICTION IN LINE
OR COMPONENT.

THEN: Confirm condition by a thorough physical and visual inspection
of all lines and components.

- Temperature will be much colder on the down stream side of the restriction.
- The pressures are not absolute and should be used as a guide in diagnosis.
- Replace the restricted part.
- After repair return to diagnostic flow chart.



GENERAL SYSTEM CONDITION - HIGH SIDE RESTRICTIONS

If the ambient air
temperature is . . .

AND pressure
gauge reads. . .

AND pressure
gauge reads . . .

AND right center
air reads . . .

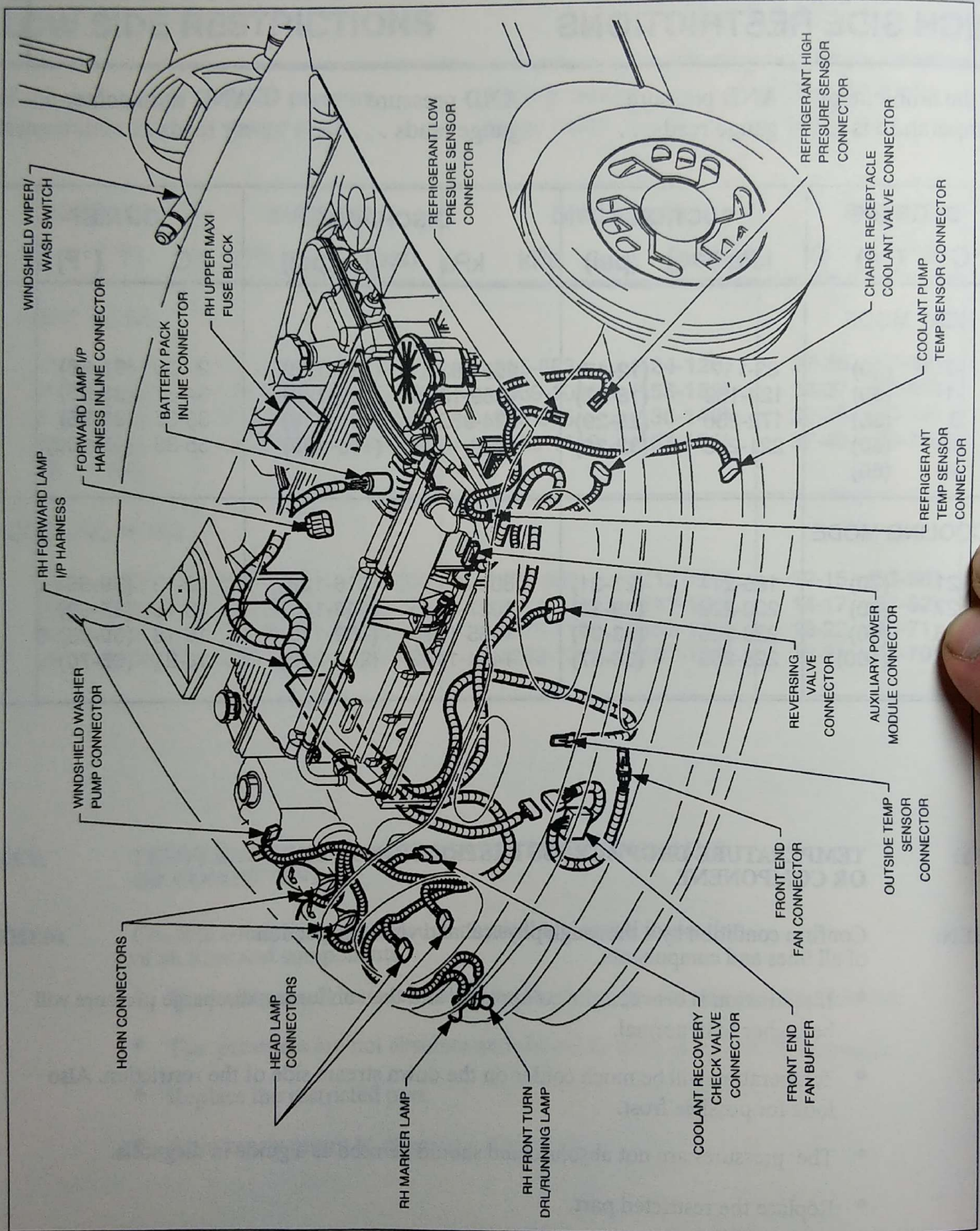
DEGREES °C (°F)	SUCTION kPa (psi)	DISCHARGE kPa (psi)	OUTLET °C (°F)
HEAT MODE			
-7 (20)	83-117 (12-17)	855-883 (124-128)	27-30 (81-86)
-1 (30)	124-152 (18-22)	1069-1096 (155-159)	34-37 (93-98)
3 (38)	172-200 (25-29)	924-952 (134-138)	33-36 (91-96)
10 (50)	221-248 (32-36)	1069-1096 (155-159)	35-38 (95-100)
16 (60)			
COOLING MODE			
21 (70)	186-214 (27-31)	800-827 (116-120)	10-13 (50-55)
27 (80)	200-228 (29-33)	1027-1055 (149-153)	13-16 (55-60)
33 (90)	228-255 (33-37)	1165-1193 (169-173)	16-18 (60-65)
38 (100)	228-255 (33-37)	1434-1462 (208-212)	18-21 (65-70)

KEY: TEMPERATURE DROP ACROSS RESTRICTION IN LINE
OR COMPONENT.

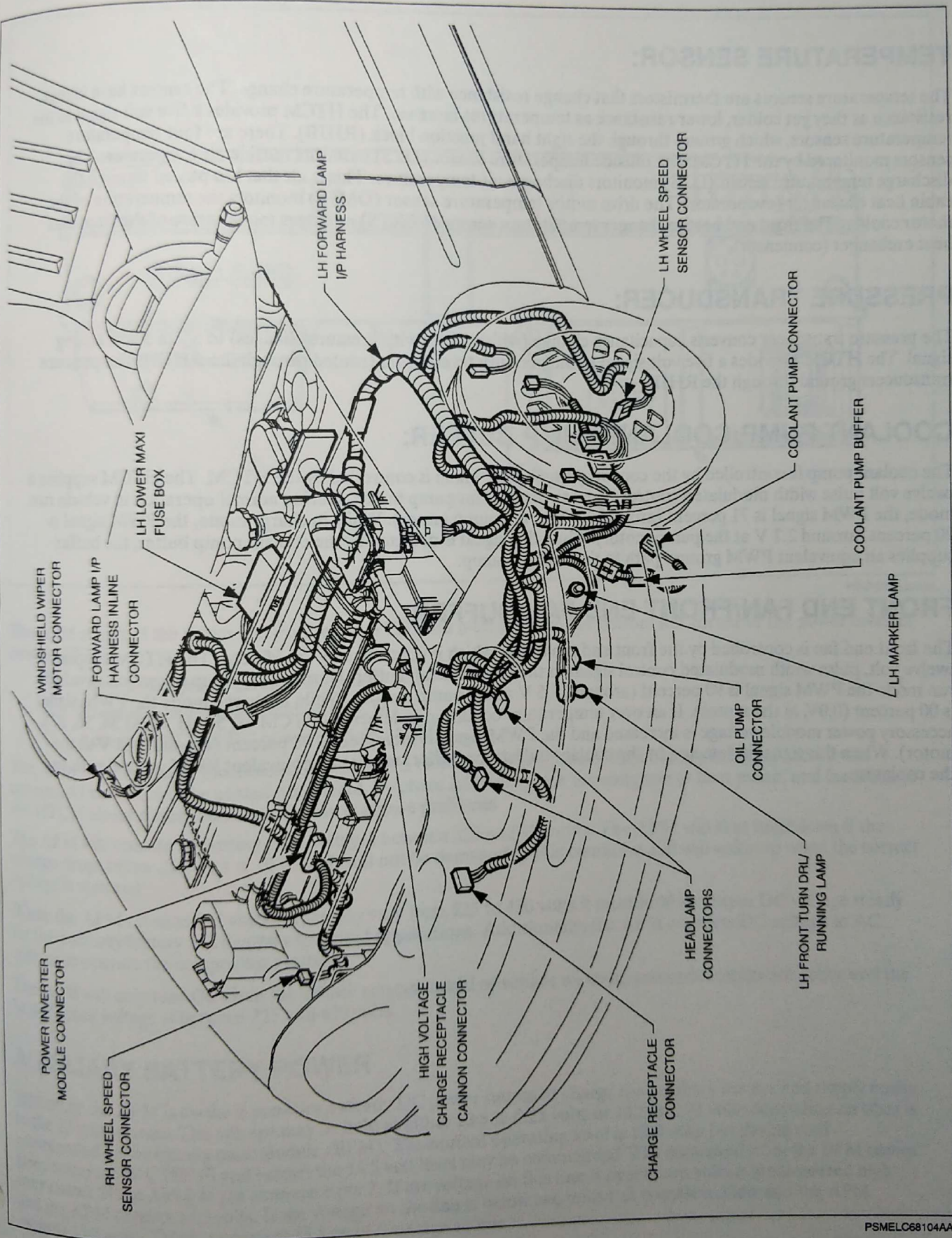
THEN: Confirm condition by a thorough physical and visual inspection
of all lines and components.

- If restriction is between the compressor and the condenser, discharge pressure will be higher than normal.
- Temperature will be much colder on the down stream side of the restriction. Also look for possible frost.
- The pressures are not absolute and should be used as a guide in diagnosis.
- Replace the restricted part.
- After repair return to diagnostic flow chart.

CLIMATE CONTROLS LOCATION VIEWS



PSMELC68103AA



PSMELC68104AA

HTCM GENERAL DESCRIPTION

TEMPERATURE SENSOR:

The temperature sensors are thermistors that change resistance with temperature change. The sensors have higher resistance as they get colder, lower resistance as temperatures increase. The HTCM provides a five volt signal to the temperature sensors, which ground through the right hand junction block (RHJB). There are four temperature sensors monitored by the HTCM. The outside temperature sensor (OTS) monitors outside air temperature. The discharge temperature sensor (DTS) monitors discharge air temperature. This is air that has passed through the cabin heat exchanger (evaporator). The drive motor temperature sensor (DMTS) monitors the temperature of the motor coolant. The front end heat exchanger temperature sensor (FEXTS) monitors temperature of the front end heat exchanger (condenser).

PRESSURE TRANSDUCER:

The pressure transducer converts capacitance change (which varies with pressure changes) to a 0 to 5 volt analog signal. The HTCM provides a five volt signal to the pressure transducers (routed through the RHJB). The pressure transducers ground through the RHJB.

COOLANT PUMP/COOLANT PUMP BUFFER:

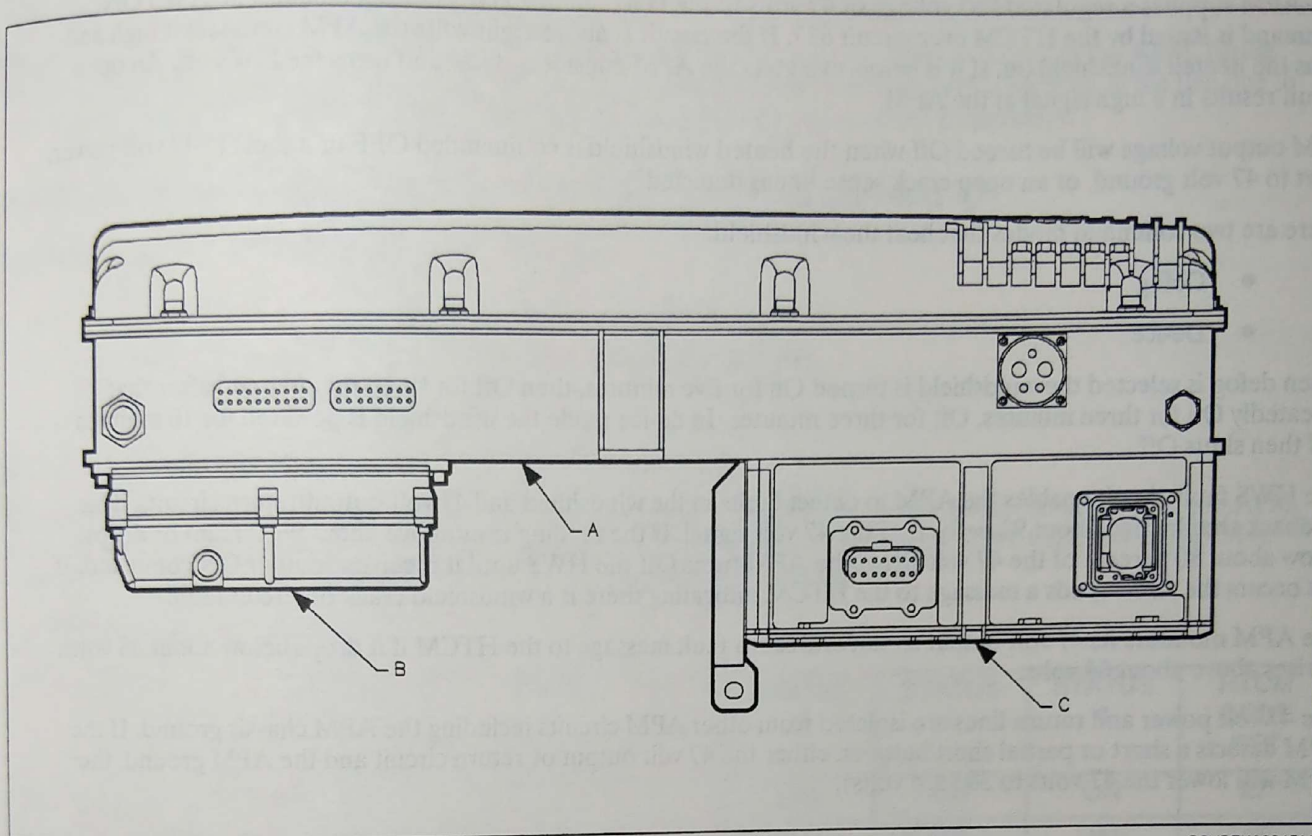
The coolant pump is controlled by the coolant pump buffer which is controlled by the HTCM. The HTCM supplies a twelve volt pulse width modulated control signal to the coolant pump buffer. During normal operation in vehicle run mode, the PWM signal is 71 percent (around 9.4 V at the pump motor). While in charge mode, the PWM signal is 20 percent (around 2.7 V at the pump motor). When this signal is detected by the coolant pump buffer, the buffer supplies an equivalent PWM ground path to the coolant pump.

FRONT END FAN/FRONT END FAN BUFFER:

The front end fan is controlled by the front end fan buffer which is controlled by the HTCM. The HTCM supplies a twelve volt, pulse width modulated control signal to the front end fan buffer. During heat pump operation in vehicle run mode the PWM signal is 90 percent (around 12.5 V at the pump motor). While in charge mode the PWM signal is 00 percent (0.0V, at the motor). If an over temperature condition is detected (HTCM 48, 50, 51, PCM 34, 36, 37), accessory power module voltage is increased and the PWM signal is increased to 98 percent (around 14.4 V at the motor). When this signal is detected by the coolant buffer, the buffer supplies an equivalent PWM ground path to the coolant.



ACCESSORY AC AND DC POWER MODULE (APM)



PSMPEN66845AA

The APM is part of the power electronics bay (PEB) and is attached to the bottom left corner of the power inverter module (PIM).

- A: Drive motor power inverter module (PIM)
- B: Power steering control module (PSCM)
- C: Accessory AC and DC power module (APM)

The APM has four major functions; it provides 13.5 or 14.5 volts DC for auxiliary battery charging and 12 volt systems, 47 volt DC for the heated windshield, 3-phase AC voltage for the compressor heat pump, and feedback to the HTCMT about system operation to help diagnose problems

The APM will operate on battery pack voltages between 225 and 430 volts. The APM will shut itself down if the voltage drops below 215 volts $\pm$ 10 volts. It will not be damaged by this condition and will wake-up when the correct voltage is restored.

While the APM receives DC voltage that may vary from 225 to 430 volts it must hold its output DC voltage steady for the auxiliary battery and heated windshield applications. Additionally, the APM converts DC voltage to AC voltage to operate the compressor motor.

The APM will only turn On when the vehicle run command or vehicle wake-up command inputs are active and the battery pack voltage is between 225 and 430 volts.

AUXILIARY BATTERY POWER

Whenever the APM is awake it provides a steady DC power source to charge the auxiliary battery and supply power to the 12 volt systems. This voltage may be held at either 13.5 ± 0.25 volts or 14.5 ± 0.25 volts depending on what is commanded by the battery pack module (BPM). The normal operating level is 13.5 volts but during cold temperatures (15°C [59°F] and below) the 14.5 volt level may be commanded. The command from the BPM comes over circuit 249 to APM 24 pin connector pin 2. If the voltage on this line is over seven volts it is considered high and the APM outputs 14.5 volts. If the voltage on the line is below two volts it is considered low and the APM outputs 13.5 volts. This is a constant 13.5 or 14.5 voltage source.

The APM is able to output up to 100 amps of current as long as the battery pack voltage level is between 225 and 430 volts. The APM puts out this power at 85 percent efficiency in the normal range of 250 – 390 volts and at least 80 percent efficiency over the entire range of 225 – 430 volts under moderately heavy loads.



HEATED WINDSHIELD (HWS) CONTROL

The APM supplies a regulated DC voltage of 47 volts to the HWS upon a HWS ON command. The HWS ON command is issued by the HTCM over circuit 637. If the circuit is above eight volts the APM considers it high and turns the heated windshield on. If it is below two volts the APM considers it low and turns the HWS off. An open circuit results in a high signal at the APM.

APM output voltage will be turned Off when the heated windshield is commanded OFF or a short to 47 volt power, short to 47 volt ground, or an open crack sense line is detected.

There are two command modes that heat the windshield:

- Defog
- De-ice

When defog is selected the windshield is turned On for five minutes, then Off for three minutes and after that repeatedly On for three minutes, Off for three minutes. In de-ice mode the windshield is powered for 10 minutes and then shuts Off.

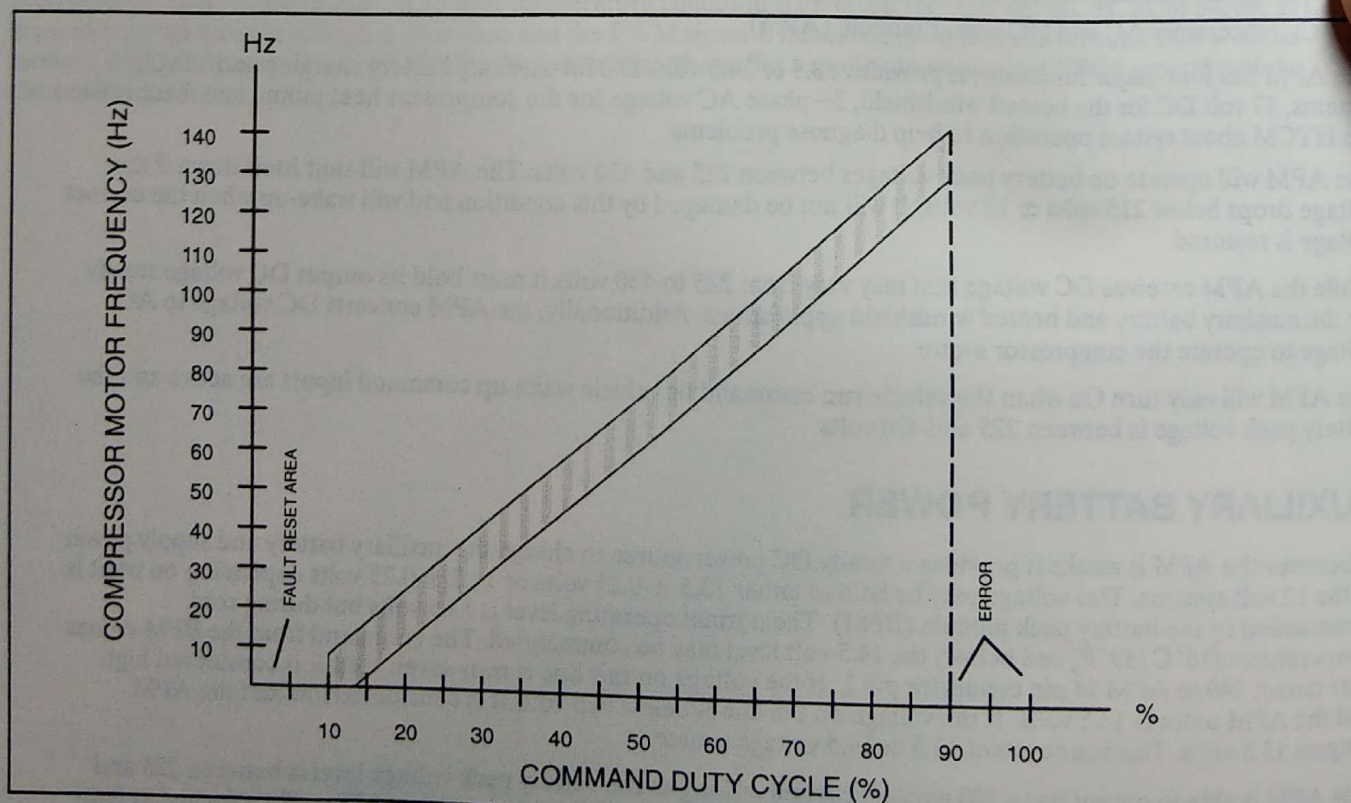
The HWS fault circuit enables the APM to detect faults in the windshield and 47 volt output/return circuits. This feedback should read about 92 percent of the 47 volt signal. If the reading rises above about 96 percent or drops below about 80 percent of the 47 volt signal the APM turns Off the HWS until it receives another ON command. If this occurs the APM sends a message to the HTCM indicating there is a windshield crack or circuit fault.

The APM monitors its 47 volt output circuit and sets a fault message to the HTCM if it drops below about 38 volts, or rises above about 64 volts.

The 47 volt power and return lines are isolated from other APM circuits including the APM chassis ground. If the APM detects a short or partial short between either the 47 volt output or return circuit and the APM ground, the APM will lower the 47 volts to 38 (± 4 volts).

COMPRESSOR CONTROL

The APM receives a pulse width modulated (PWM) signal from the HTCM that is used to control the frequency of the three phase AC output voltage for the compressor. The output frequency varies based on the duty cycle from the HTCM as shown in the table below.



The power to the compressor is monitored and limited by the APM/PEB to help provide overload protection. The APM sends a signal to the HTCMT indicating how much power the compressor motor is drawing/being fed. If an over current condition is detected the APM will limit the output power to the compressor motor.

There is an interlock circuit that runs from the APM through the compressor motor and back to the APM. Inside the compressor this loop passes through a normally closed temperature switch. If there is an open in the line due to a disconnect or an overheat in the compressor the APM turns Off the power to the compressor.

APM STATUS MESSAGES AND LOAD SHED COMMAND

The APM reports to the HTCMT over seven status lines;

- Three regarding APM operation and 12 volt status.
- Three regarding HWS and compressor operation and faults.
- One for the load shed command.

The state of these status lines is available over HTCMT serial data.

The following tables show the state of the lines from the APM to the HTCMT for the given conditions. For the APM to recognize one of the inputs as being ON the voltage on the line must be between 0 and 1 volts. For the APM to recognize one of the inputs as being OFF the line must be between 8 and 16 volts.

12 VOLT STATUS LINES

CONDITION	STATUS 2	STATUS 1	STATUS 0	HTCM CODE SET
APM disabled or APM off	ON	ON	ON	27
APM over-temperature (shutdown)	ON	ON	OFF	46
12 volt voltage > 16 volt OR 12 volt voltage < 10.5 volt and 12 volt current < 100 amps	ON	OFF	ON	37
12 volt voltage < 10.5 volt	ON	OFF	OFF	38
12 volt voltage < 13.25 volt and 12 volt current < 100 amps	OFF	ON	ON	39
12 volt current > 100 amps (maintain until current < 70 amps)	OFF	ON	OFF	NONE
Unused	OFF	OFF	ON	N/A
Normal operation	OFF	OFF	OFF	N/A

HWS AND COMPRESSOR STATUS LINES

CONDITION	STATUS 2	STATUS 1	STATUS 0	HTCM CODE SET
Cracked windshield or open windshield connector	ON	ON	ON	28
47 volt HWS isolation < 75kΩ ± 25Ω	ON	ON	OFF	41
47 volt voltage < 45.5 volt or 47 volt voltage > 55.0 volt	ON	OFF	ON	42
47 volt: Normal operation or not requested	ON	OFF	OFF	NONE
CMC IGBT fault (shutdown compressor)	OFF	ON	ON	29 OR 30
HV input to CMC over (430 volt)/under voltage (215 volt) (shutdown compressor)	OFF	ON	OFF	31
Compressor motor interlock open due to motor overtemp or connector not engaged.	OFF	OFF	ON	32
CMC function: normal operation or not requested	OFF	OFF	OFF	NONE



IMPORTANT: The HTCM DTCs set as a result of the APM status feedback, result in a variety of actions by the HTCM depending on the failure. Refer to the appropriate codes in the HVAC electrical service manual for more information on these DTCs.

LOAD SHED COMMAND

The APM will command load shed to the HTCM whenever its 12 volt output to the auxiliary battery falls below 10.5 volts and the service brake is applied. The HTCM responds to this command by turning Off power to the rear defogger and the blower for the duration of the command. Whenever a load shed command is received by the HTCM it sets a DTC 37 and sets output bit APS failure. This informs the BPM to disable the battery pack fan. Disabling these loads helps assure adequate power is available for braking. As soon as the brake is released or the 12 volt supply rises above 10.5 volts the load shed command is turned Off.

APM WAKEUP/RUN

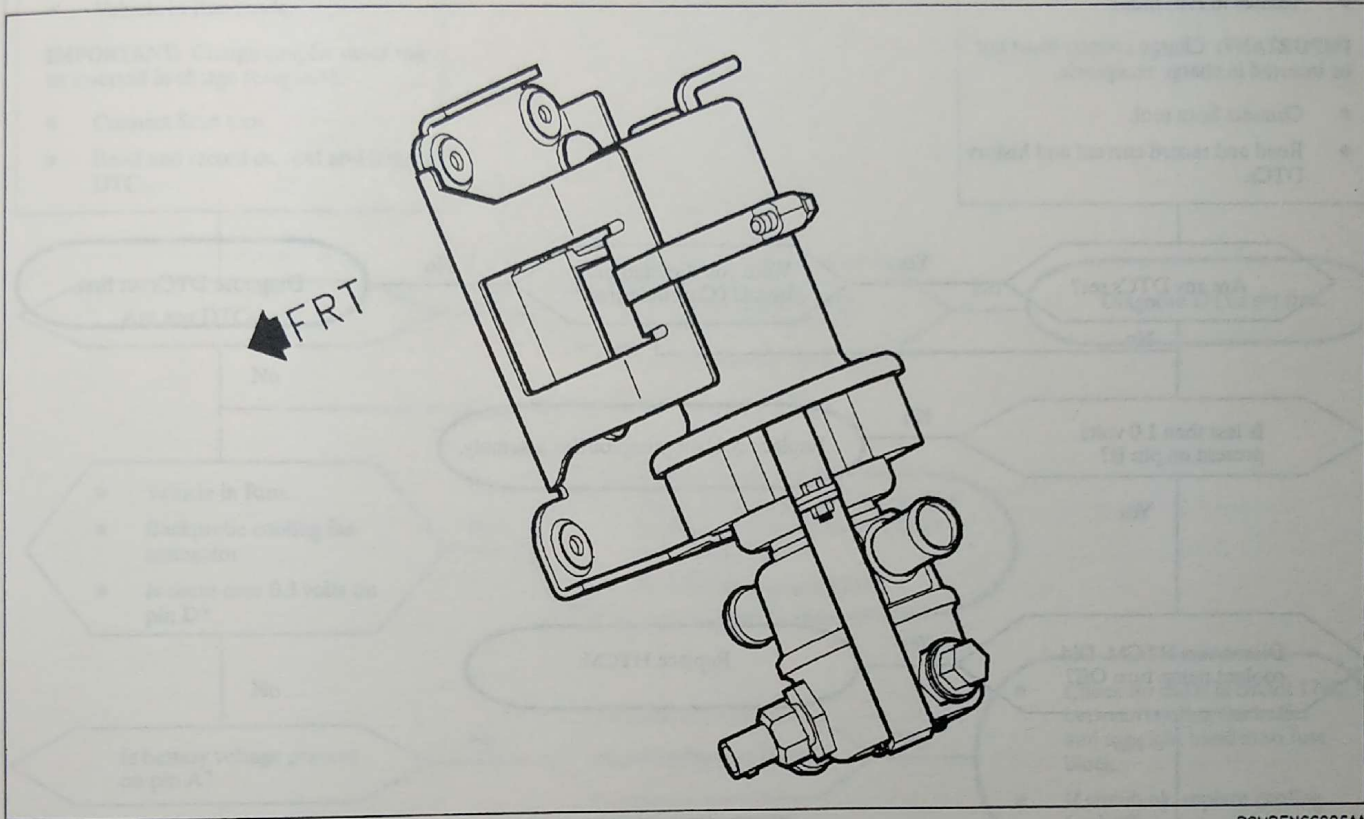
The APM turns On when its wakeup circuit is pulled high (12 volts). The wakeup circuit can be asserted (pulled high) by the BPM, HTCM, battery recovery switch, or when the charge coupler is inserted into the charge receptacle.

The APM will also turns On when the RSA asserts Run 2 to the APM.



GENERAL DESCRIPTION

WATER PUMP ASSEMBLY



PSMPEN66996AA

The water pump assembly consists of three major components, the electric water pump motor, the water pump and the water pump manifold.

The electric water pump motor is a 12 volt pulse width modulated DC motor that is controlled by the heat pump ventilation system/thermal control module (HTCM), based on coolant temperature sensor readings from the power electronics bay (PEB), drive unit, water pump manifold and battery pack module (BPM) requests. Pulse width modulation allow the HTCM to run the water pump motor from 5 volts to 14 volts, this controls the coolant flow rate and maintains the optimal coolant temperature eliminating the need for a thermostat with in the coolant system. Pulse width modulation also allows the electric water pump to soft start the motor which reduces current surge and increases motor life.

The water pump is driven by the electric water pump motor and distributes the coolant through the cooling system. The water pump is a compact close tolerance impeller type pump.

The water pump manifold has several functions, zero pressure loss return for radiator and heater, vents to expansion tank to prevent cavitation, houses a coolant temperature sensor, two way feed to coolant vessel which maintains the coolant level during the fill procedure, venting and pressure relief. The water pump manifold drain plug is the main drain path for the coolant system drain procedure.

CHART 1 COOLANT PUMP STAYS ON

- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record current and history DTCs.

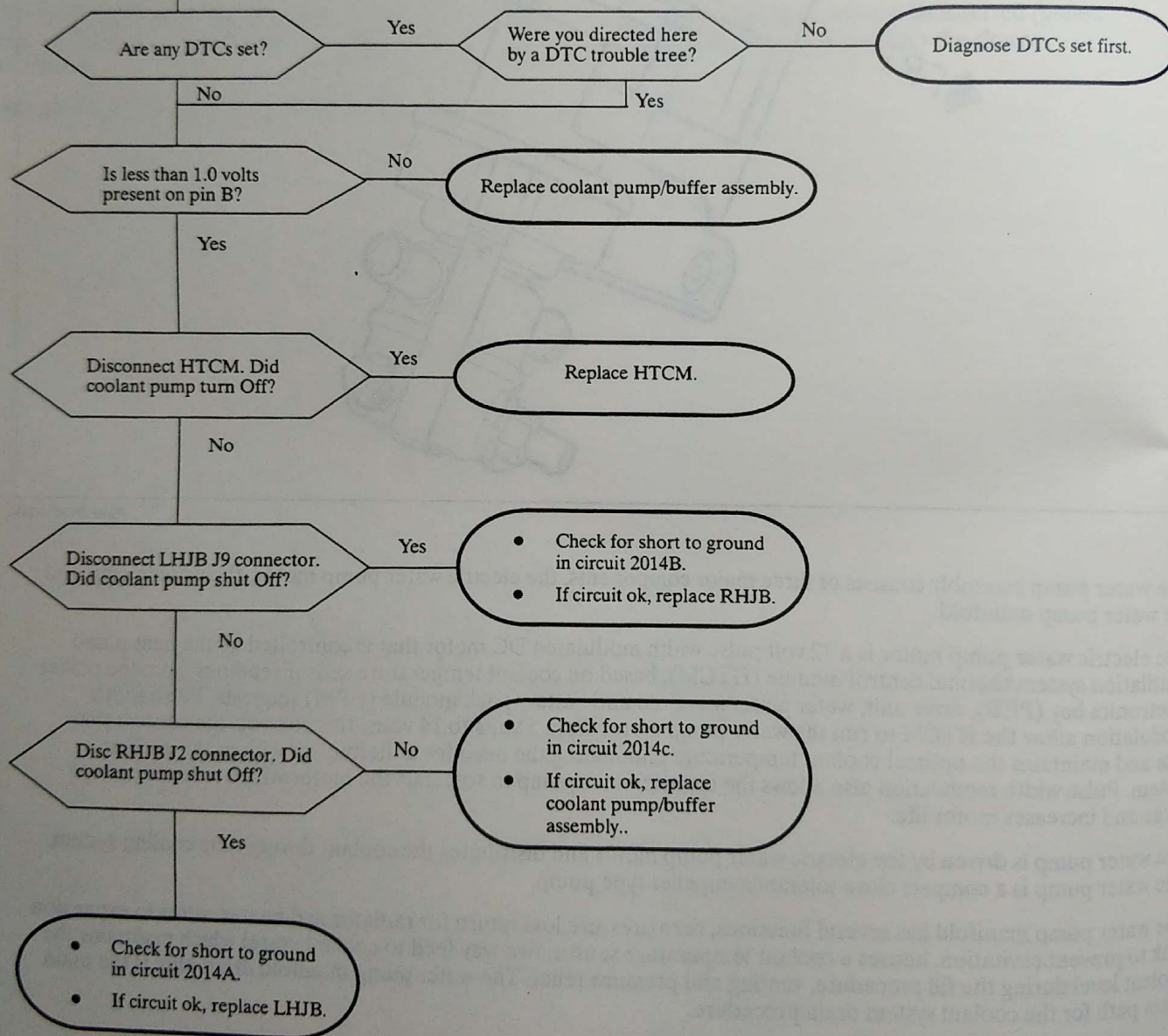


CHART 2

CHART 2 COOLING FAN INOPERATIVE

- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record current and history DTCs.

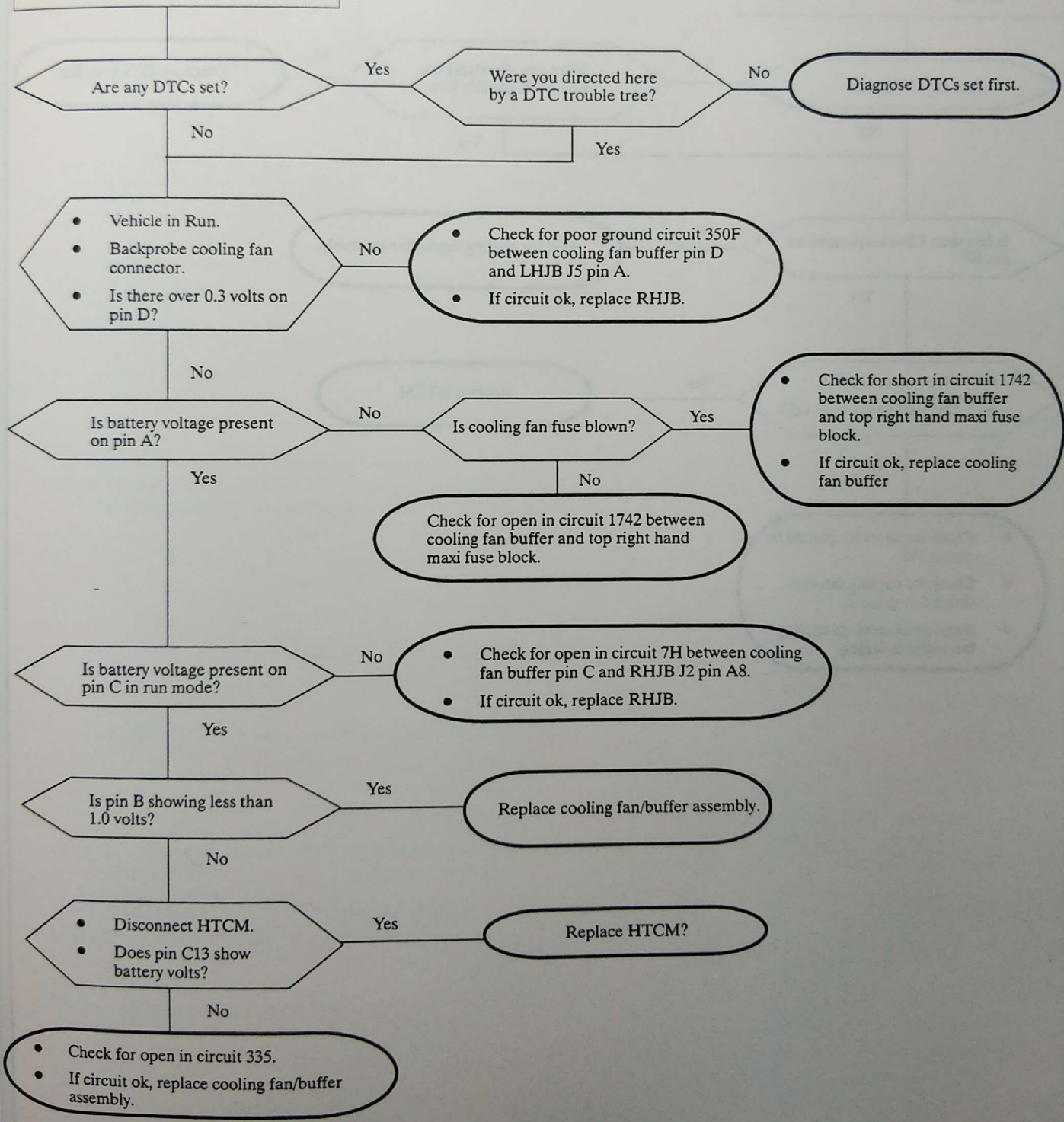
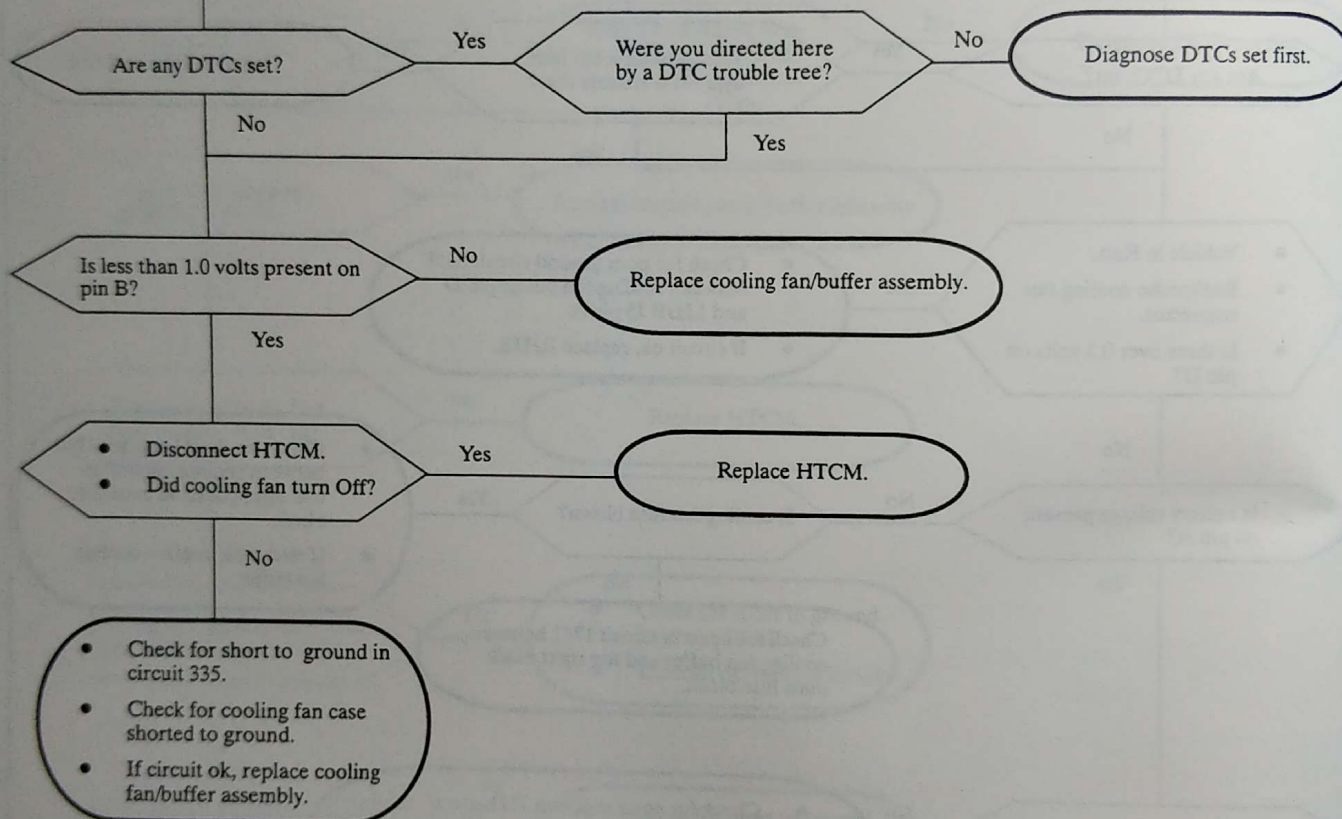
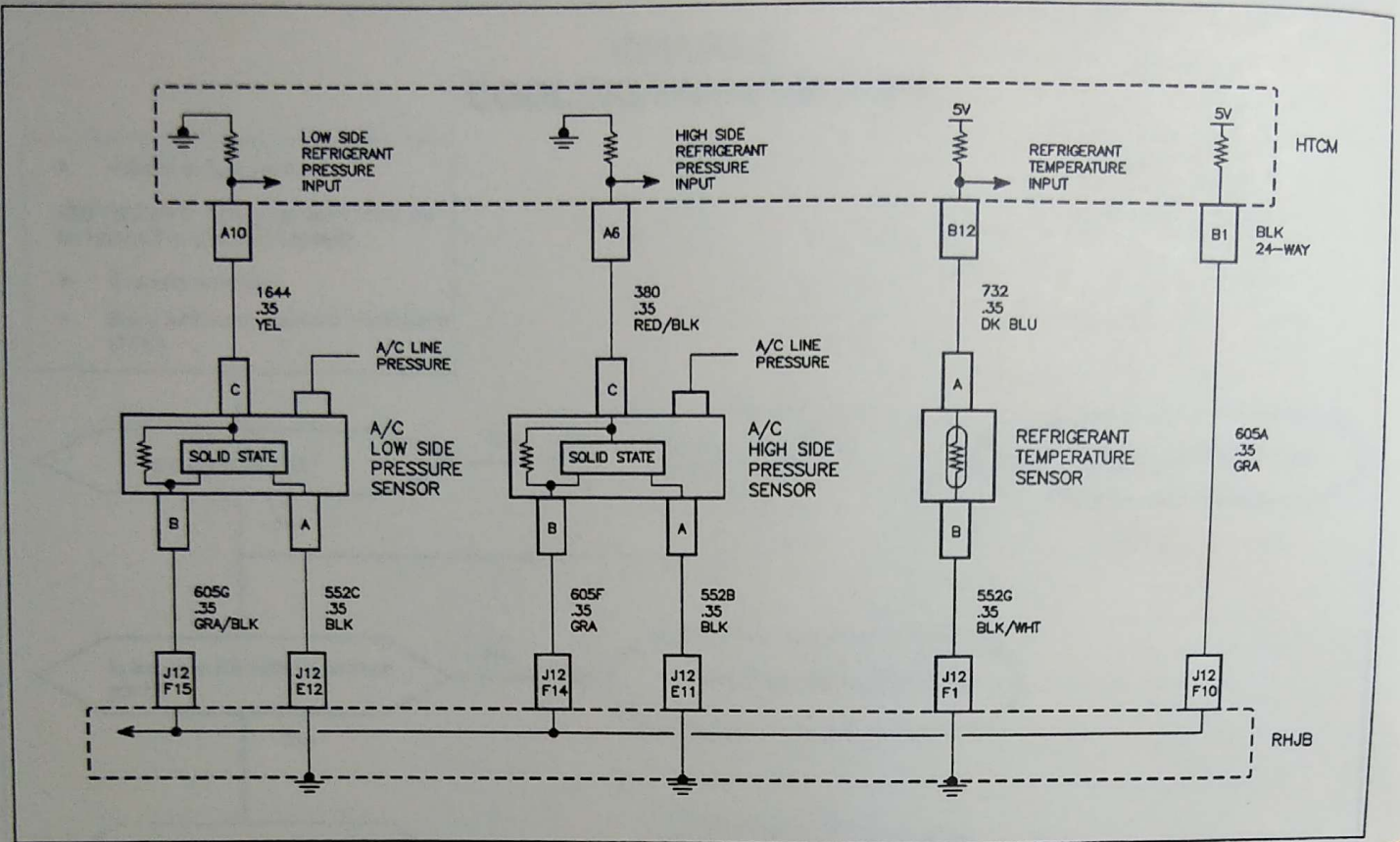


CHART 3 COOLING FAN STAYS ON

- Vehicle in Run mode.
- IMPORTANT:** Charge coupler must not be inserted in charge receptacle.
- Connect Scan tool.
- Read and record current and history DTCs.



DTC 10 – HIGH SIDE PRESSURE TRANSDUCER OPEN/SHORT



PSMELC68180AA

HIGH SIDE PRESSURE TRANSDUCER OPEN/SHORT

The pressure transducers convert capacitance change (which varies with pressure changes) to a 0 to 5 volt analog signal. The HPVS/thermal control module (HTCM) monitors input from the transducers. The sensor can measure a range from 0.23 volts (20 kPa) to 4.9 volts (2800 kPa). If the input goes outside the normal range, this fault will be set and the heat pump will be disabled.

DTC PARAMETERS

DTC 10 will set if:

- Open or short to ground or voltage in the high side transducer circuit.
- Faulty transducer.
- HTCM failure.

DTC 10 will set when:

Anytime the HTCM is awake. This fault exists if the HTCM detects less than 0.06 volts or more than 4.9 volts on the high side transducer input circuit.

FAILURE ACTION

Heat pump operation will be disabled.

RELATED DTCS

HTCM 053

TELLTALE ILLUMINATED:

None

OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

Check the tightness of the female terminal grip with a spare male terminal.

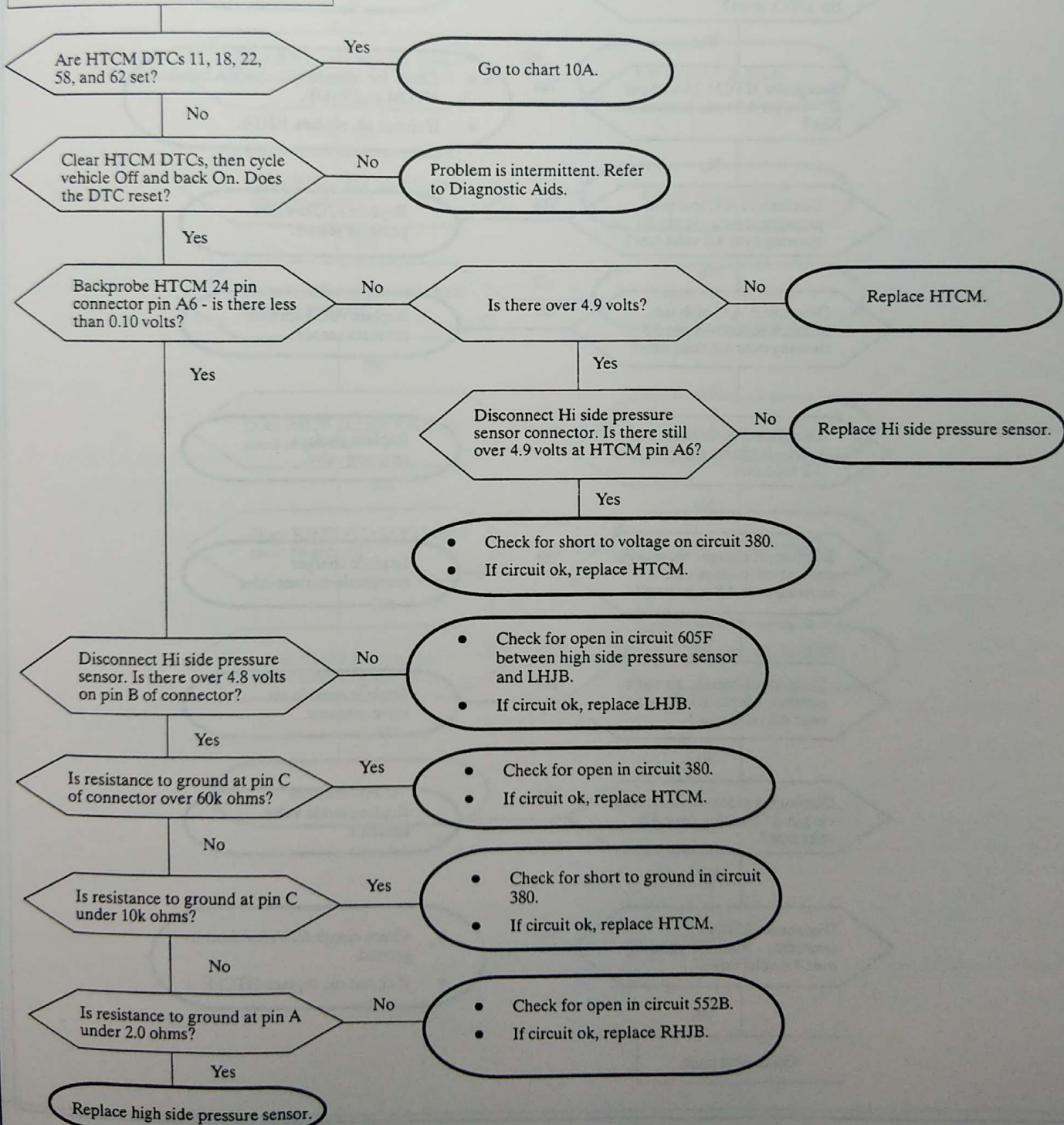
If the problem is intermittent wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

DTC 10 HIGH SIDE PRESSURE TRANSDUCER OPEN/SHORT

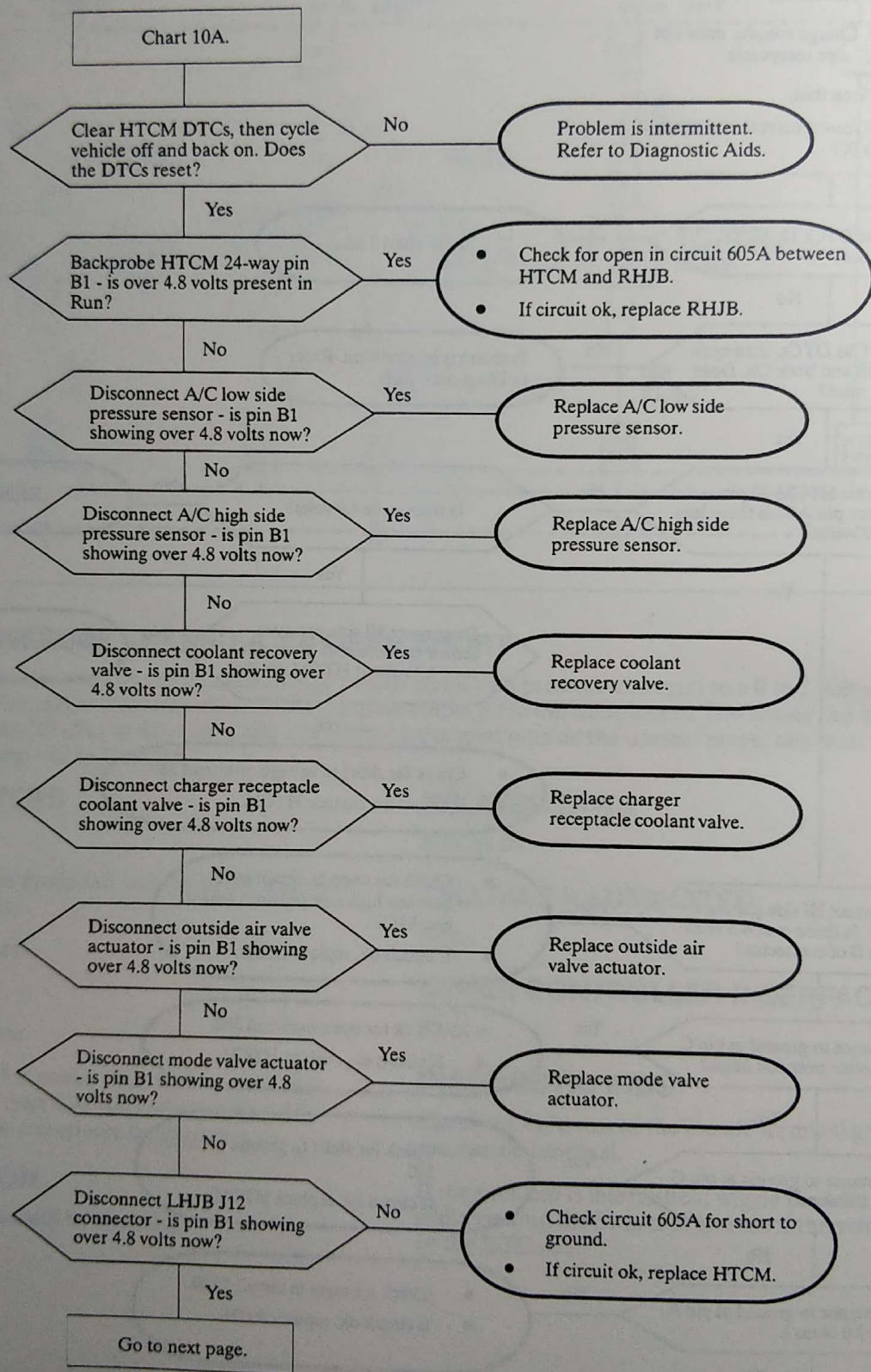
- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

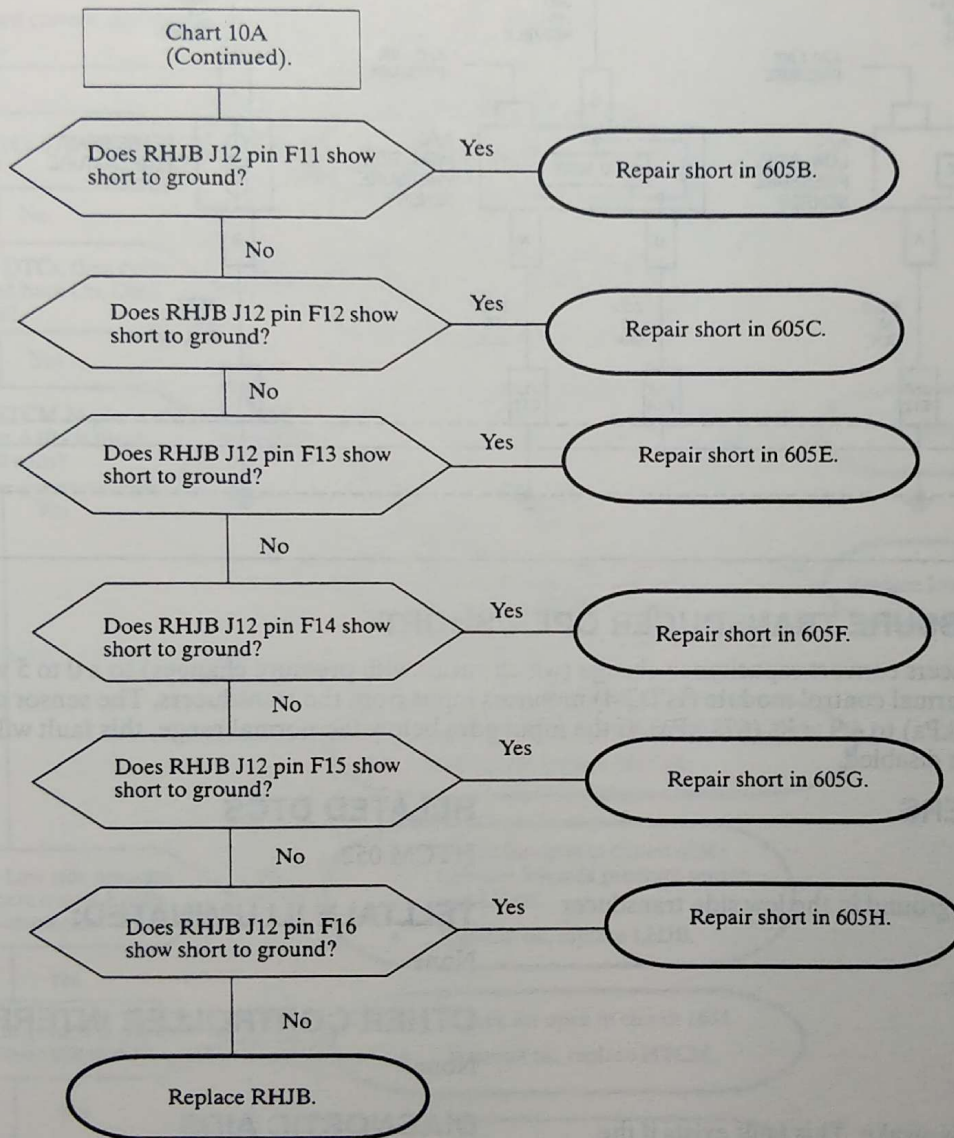
- Connect Scan tool.
- Read and record current and history HTCM DTCs.



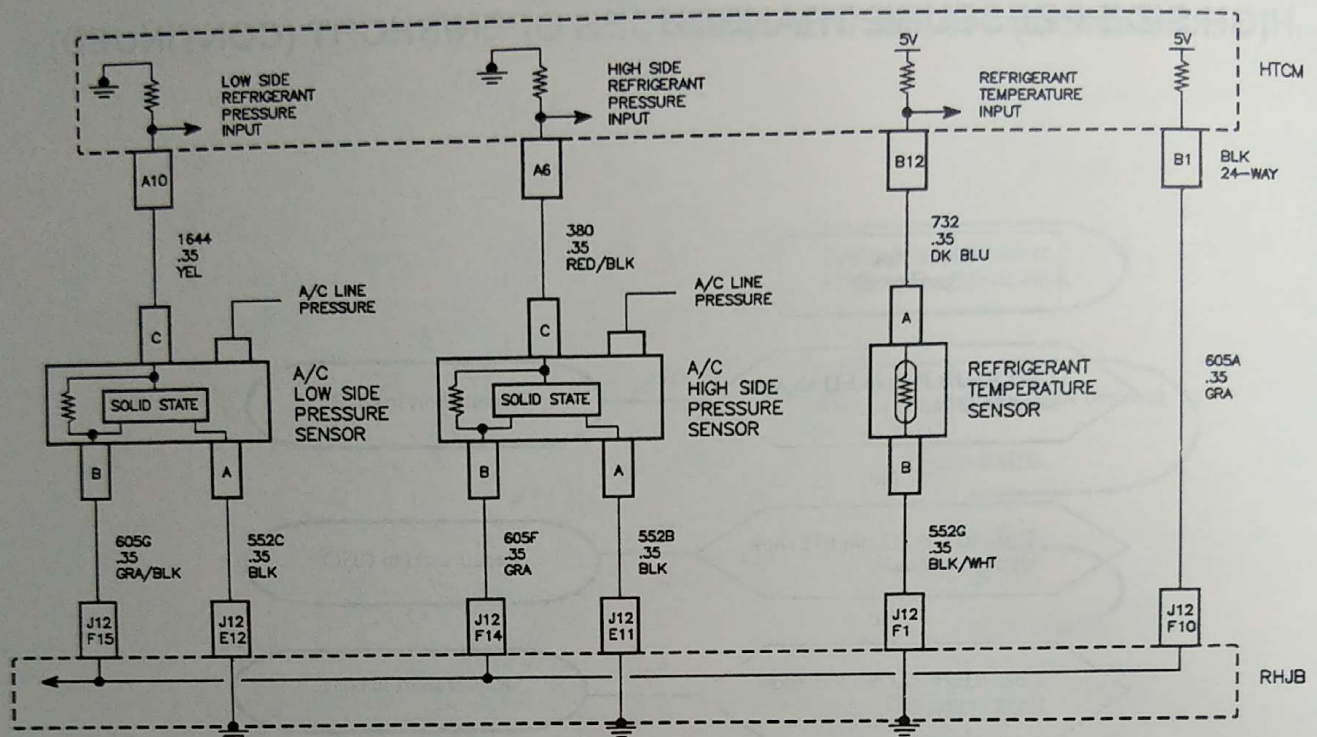
DTC 10A HIGH SIDE PRESSURE TRANSDUCER OPEN/SHORT (CONTINUED)



DTC 10A HIGH SIDE PRESSURE TRANSDUCER OPEN/SHORT (CONTINUED)



DTC 11 – LOW SIDE PRESSURE TRANSDUCER OPEN/SHORT



PSMELC68180AA

LOW SIDE PRESSURE TRANSDUCER OPEN/SHORT

The pressure transducers convert capacitance change (which varies with pressure changes) to a 0 to 5 volt analog signal. The HPV/thermal control module (HTCM) monitors input from the transducers. The sensor operating range is 0.2 volts (30 kPa) to 4.9 volts (671 kPa). If the input goes below the normal range, this fault will be set and the heat pump will be disabled.

DTC PARAMETERS

DTC 11 will set if:

- Open or short to ground in the low side transducer circuit.
- Faulty transducer.
- HTCM failure.

DTC 11 will set when:

Anytime the HTCM is awake. This fault exists if the HTCM detects less than 0.10 volts on the Low Side transducer input circuit. The HTCM will not detect a short to voltage since normal operating pressures may cause the transducer to indicate 5.0 volts.

FAILURE ACTION

Heat pump operation will be disabled.

RELATED DTCS

HTCM 052

TELLTALE ILLUMINATED:

None

OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

Check the tightness of the female terminal grip with a spare male terminal.

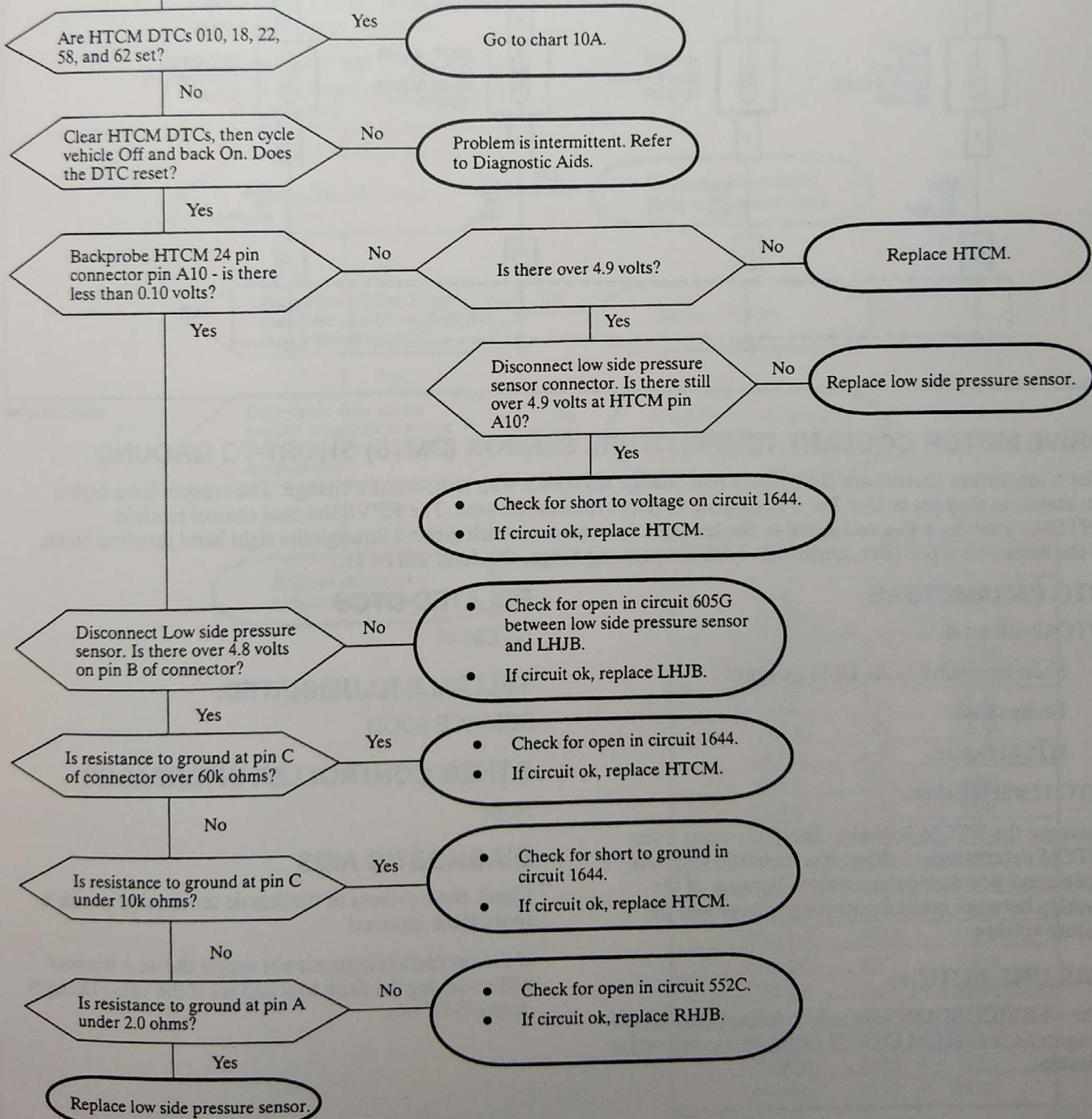
If the problem is intermittent wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

DTC 11 LOW SIDE PRESSURE TRANSDUCER OPEN/SHORT

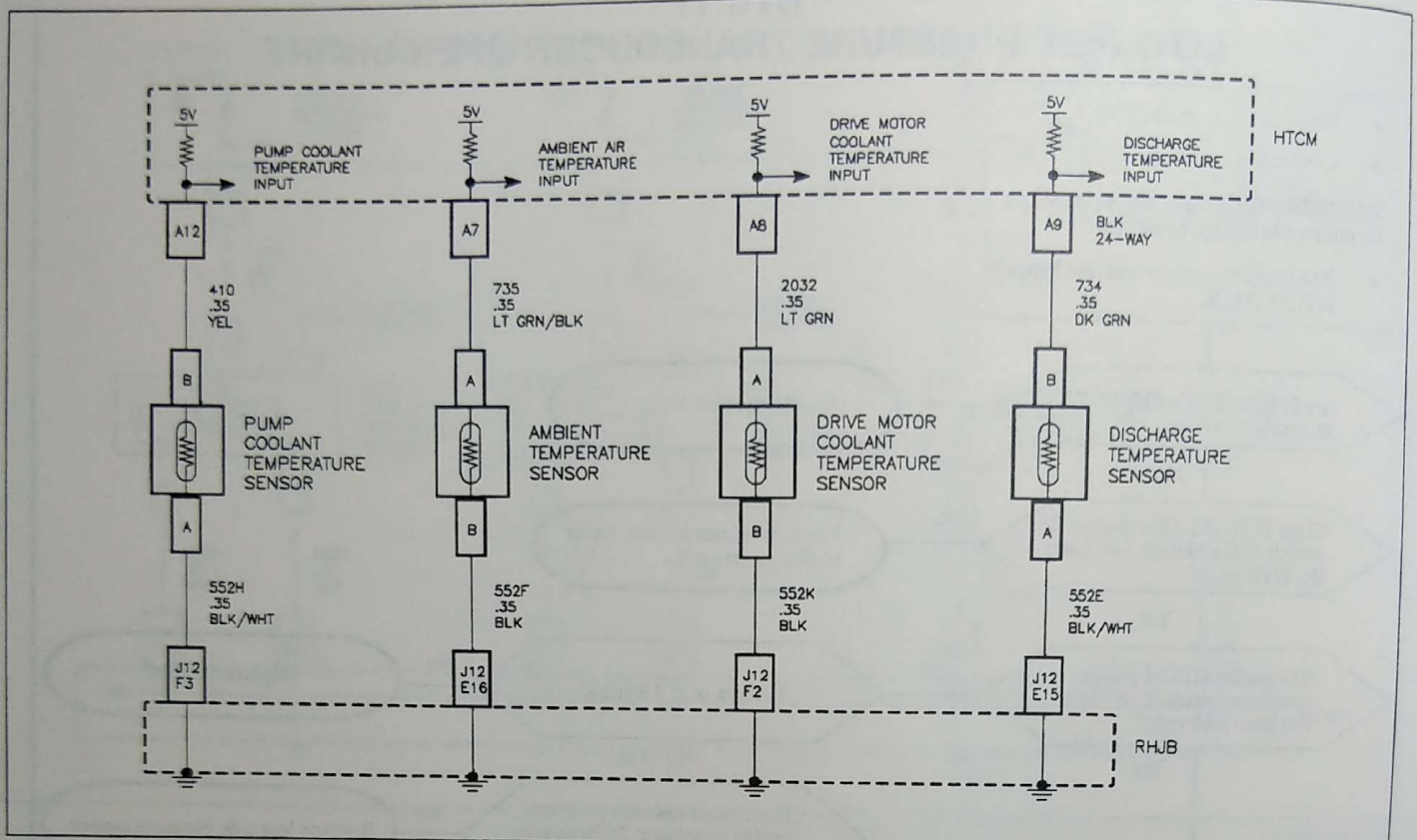
- Vehicle in Run mode.
- Connect Scan tool.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Read and record current and history HTCM DTCs.



DTC 12 – DRIVE MOTOR COOLANT TEMPERATURE SENSOR (DMTS) SHORT TO GROUND



PSMELC68181AA

DRIVE MOTOR COOLANT TEMPERATURE SENSOR (DMTS) SHORT TO GROUND

The temperature sensors are thermistors that change resistance with temperature change. The sensors have higher resistance as they get colder, lower resistance as temperatures increase. The HPVS/thermal control module (HTCM) provides a five volt signal to the temperature sensors, which ground through the right hand junction block. If the measured input goes outside the normal operating range, this fault will be set.

DTC PARAMETERS

DTC 12 will set if:

- Short to ground in the DMTS circuit.
- Faulty sensor.
- HTCM failure.

DTC 12 will set when:

Anytime the HTCM is awake. This fault exists if the HTCM detects input voltage less than 0.06 volts. An open condition cannot be detected because of the overlap between normal operating voltage and the failure voltage.

FAILURE ACTION

The SERVICE SOON light will be turned On and the diagnostic for HTCM DTC 48 (drive unit overheat) is disabled.

RELATED DTCS

HTCM 48

TELLTALE ILLUMINATED:

SERVICE SOON

OTHER CONTROLLER INTERFACES

None

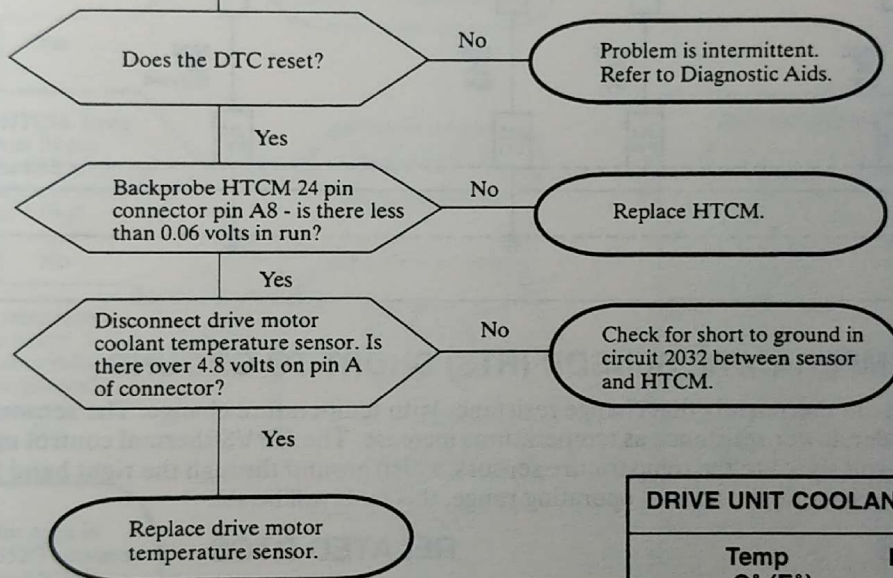
DIAGNOSTIC AIDS

Check the tightness of the female terminal grip with a spare male terminal.

If the problem is intermittent wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

DTC 12 DRIVE MOTOR COOLANT TEMPERATURE SENSOR (DMTS) SHORT TO GROUND

- Vehicle in Run mode.
- IMPORTANT:** Charge coupler must not be inserted in charge receptacle.
- Connect Scan tool.
- Read and record current and history HTCM DTCs.

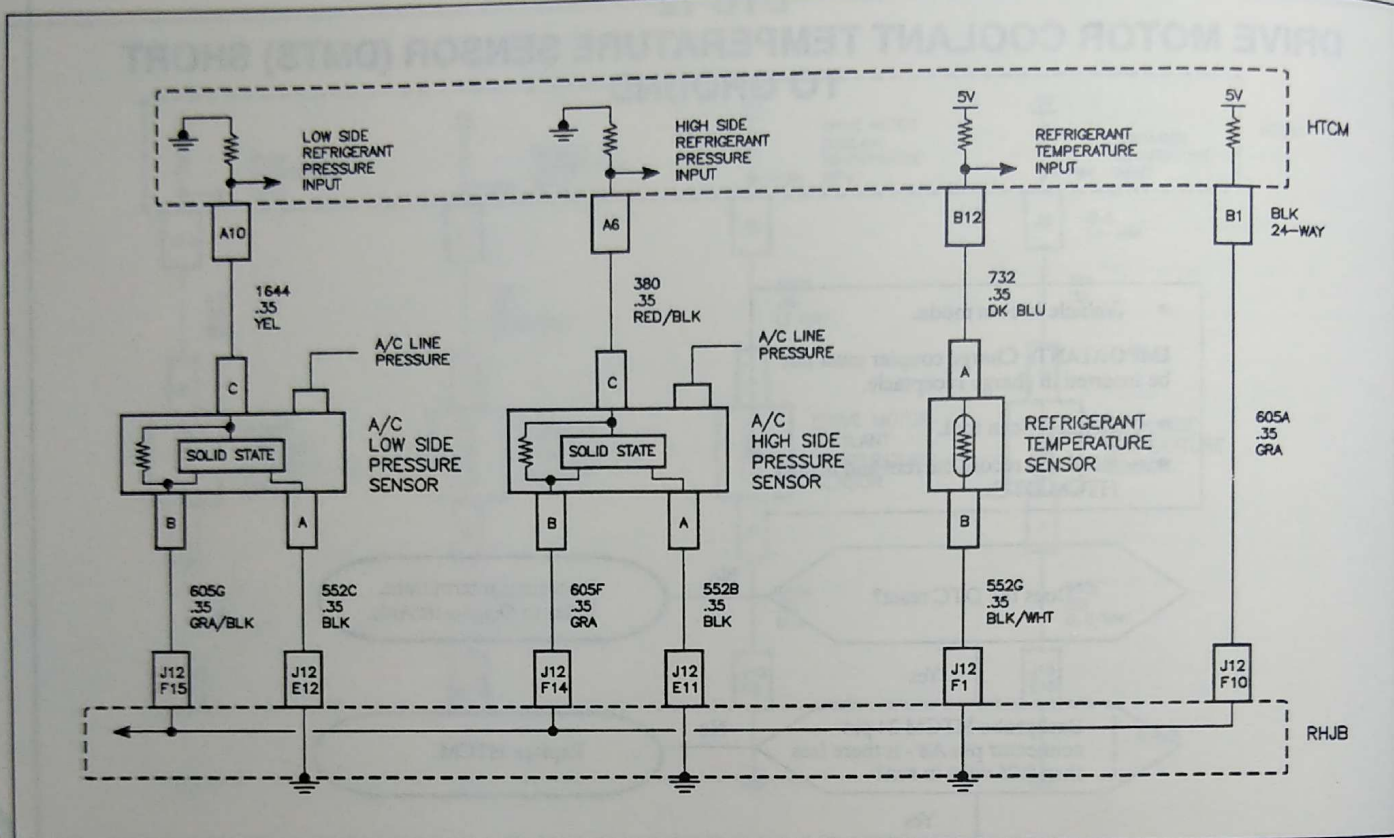


DRIVE UNIT COOLANT TEMPERATURE

Temp C° (F°)	Resistance Ohms	
-40 (-40)	73.6k	127.8k
-20 (-4)	21.9k	35.5k
0 (32)	7.5k	11.4k
10 (50)	4.5k	6.8k
20 (68)	3108	3922
30 (86)	1993	2482
35 (95)	1611	2482
40 (104)	1309	1610
45 (113)	1069	1308
50 (122)	877.9	1068
55 (131)	727.6	880
60 (140)	605.9	728.9
65 (149)	507	606.8
70 (158)	426	507.5
80 (176)	304.7	359.7
90 (194)	221.4	259.2
100 (212)	163.3	189.6
140 (284)	53.95	65.69



DTC 13 – REFRIGERANT TEMPERATURE SENSOR (RTS) SHORT TO GROUND



PSMELC68180AA

REFRIGERANT TEMPERATURE SENSOR (RTS) SHORT TO GROUND

The temperature sensors are thermistors that change resistance with temperature change. The sensors have higher resistance as they get colder, lower resistance as temperatures increase. The HPVS/thermal control module (HTCM) provides a five volt signal to the temperature sensors, which ground through the right hand junction block. If the measured input goes outside the normal operating range, this fault will be set.

DTC PARAMETERS

DTC 13 will set if:

- Short to ground in the RTS circuit.
- Faulty sensor.
- HTCM failure.

DTC 13 will set when:

Anytime the HTCM is awake. This fault exists if the HTCM detects input voltage less than 0.06 volts. An open condition cannot be detected because of the overlap between normal operating voltage and open circuit voltage.

FAILURE ACTION

The SERVICE SOON light will be turned On.

RELATED DTCS

None

TELLTALE ILLUMINATED:

None

OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

Check the tightness of the female terminal grip with a spare male terminal.

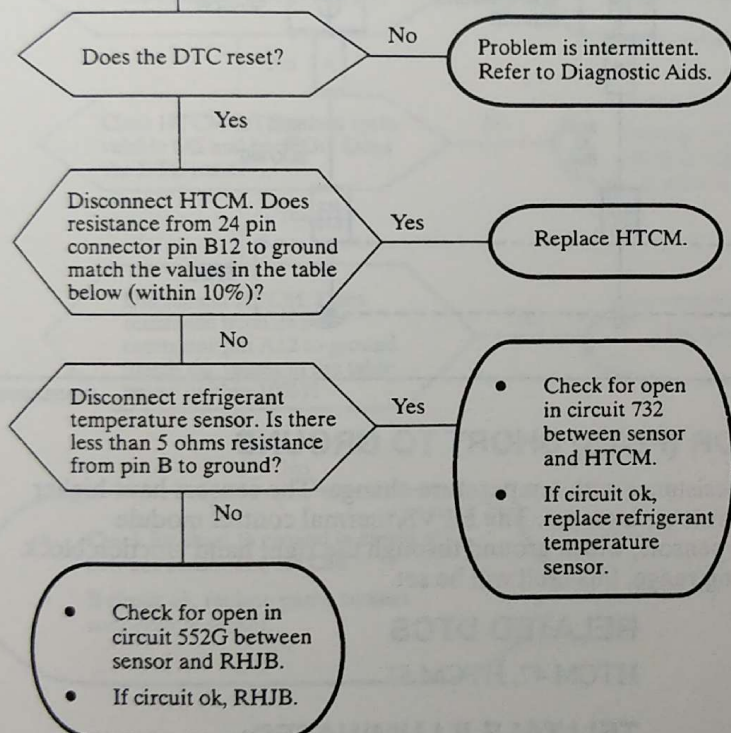
If the problem is intermittent, wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

DTC 13 REFRIGERANT TEMPERATURE SENSOR (RTS) SHORT TO GROUND

- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record current and history HTCM DTCs.
- Clear HTCM DTCs, then cycle vehicle Off and back On.

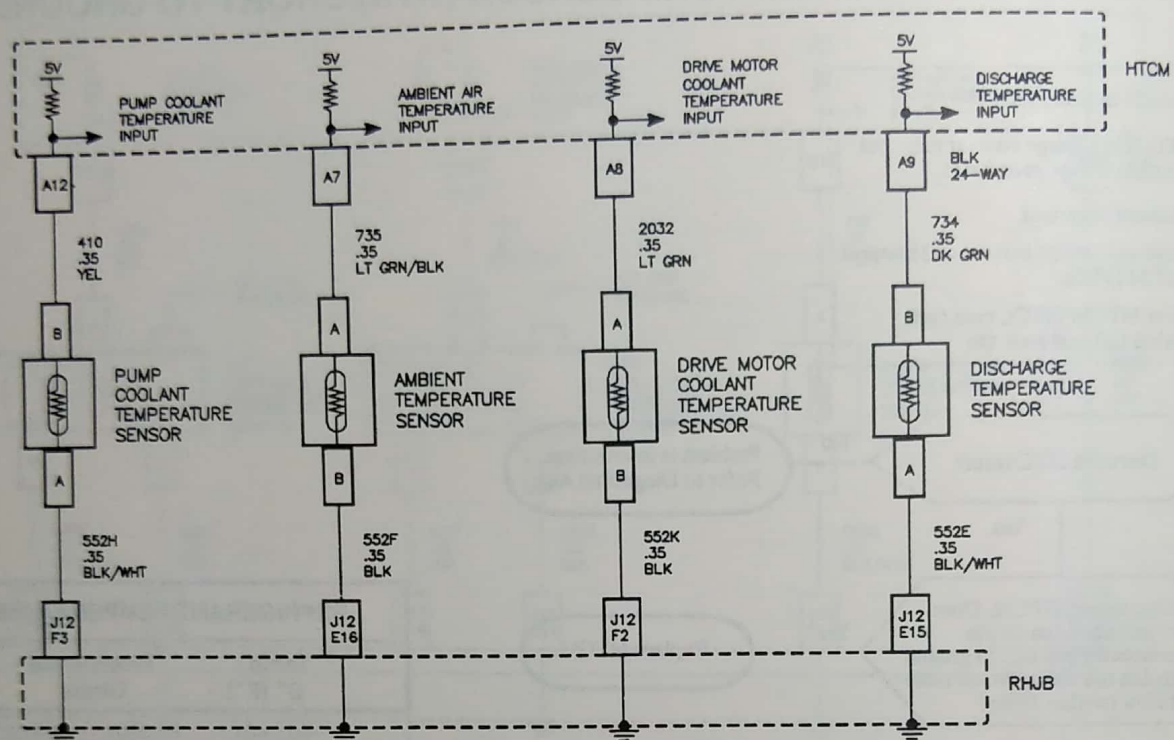


REFRIGERANT TEMPERATURE

Temp C° (F°)	Resistance Ohms	
-40 (-40)	88.950k	- 108.610k
-35 (-31)	63.974k	- 77.095k
-30 (-22)	46.659k	- 55.511k
-25 (-13)	34.482k	- 40.509k
-20 (-4)	25.801k	- 29.936k
-15 (5)	19.531k	- 22.387k
-10 (14)	14.948k	- 16.930k
-5 (23)	11.560k	- 12.939k
0 (32)	9.028k	- 9.988k
5 (41)	6.988k	- 7.646k
10 (50)	5.456k	- 5.907k
15 (59)	4.296k	- 4.604k
20 (68)	3381	- 3618
25 (77)	2725	- 2865
30 (86)	2174	- 2306
35 (95)	1747	- 1868
40 (104)	1413	- 1524
45 (113)	1150	- 1250
50 (122)	942	- 1032
55 (131)	773	- 853
60 (140)	637	- 709
65 (149)	529	- 591
70 (158)	443	- 495
75 (167)	373	- 417
80 (176)	315	- 352
85 (185)	267	- 299
90 (194)	227	- 255
95 (203)	194	- 218
100 (212)	166	- 187



DTC 14 – PUMP COOLANT TEMPERATURE SENSOR (PCTS) SHORT TO GROUND



PSMELC68181AA

PUMP COOLANT TEMPERATURE SENSOR (PCTS) SHORT TO GROUND

The temperature sensors are thermistors that change resistance with temperature change. The sensors have higher resistance as they get colder, lower resistance as temperatures increase. The HPVS/thermal control module (HTCM) provides a five volt signal to the temperature sensors, which ground through the right hand junction block. If the measured input goes outside the normal operating range, this fault will be set.

DTC PARAMETERS

DTC 14 will set if:

- Short to ground in the PCTS circuit.
- Faulty sensor.
- HTCM failure.

DTC 14 will set when:

Anytime the HTCM is awake. This fault exists if the HTCM detects input voltage less than 0.06 volts. An open condition cannot be detected because of the overlap between normal operating voltage and open circuit voltage.

FAILURE ACTION

The SERVICE SOON light will be turned On.

The front end fan and coolant pump will be commanded to high speed, the coolant recovery check value will be commanded to the radiator position, and regen will be disabled.

RELATED DTCS

HTCM 47, HTCM 51.

TELLTALE ILLUMINATED:

SERVICE SOON

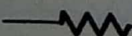
OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

Check the tightness of the female terminal grip with a spare male terminal.

If the problem is intermittent, wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.



DTC 14

PUMP COOLANT TEMPERATURE SENSOR (PCTS) SHORT TO GROUND

- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record current and history HTCM DTCs.

Are other HTCM DTCs set?

Yes

Diagnose other DTCs first.

No

Clear HTCM DTCs, then cycle vehicle Off and back On. Does the DTC reset?

No

Problem is intermittent. Refer to Diagnostic Aids.

Yes

Disconnect HTCM. Does resistance from 24 pin connector pin A12 to ground match the values in the table below (within 10%)?

Yes

Replace HTCM.

No

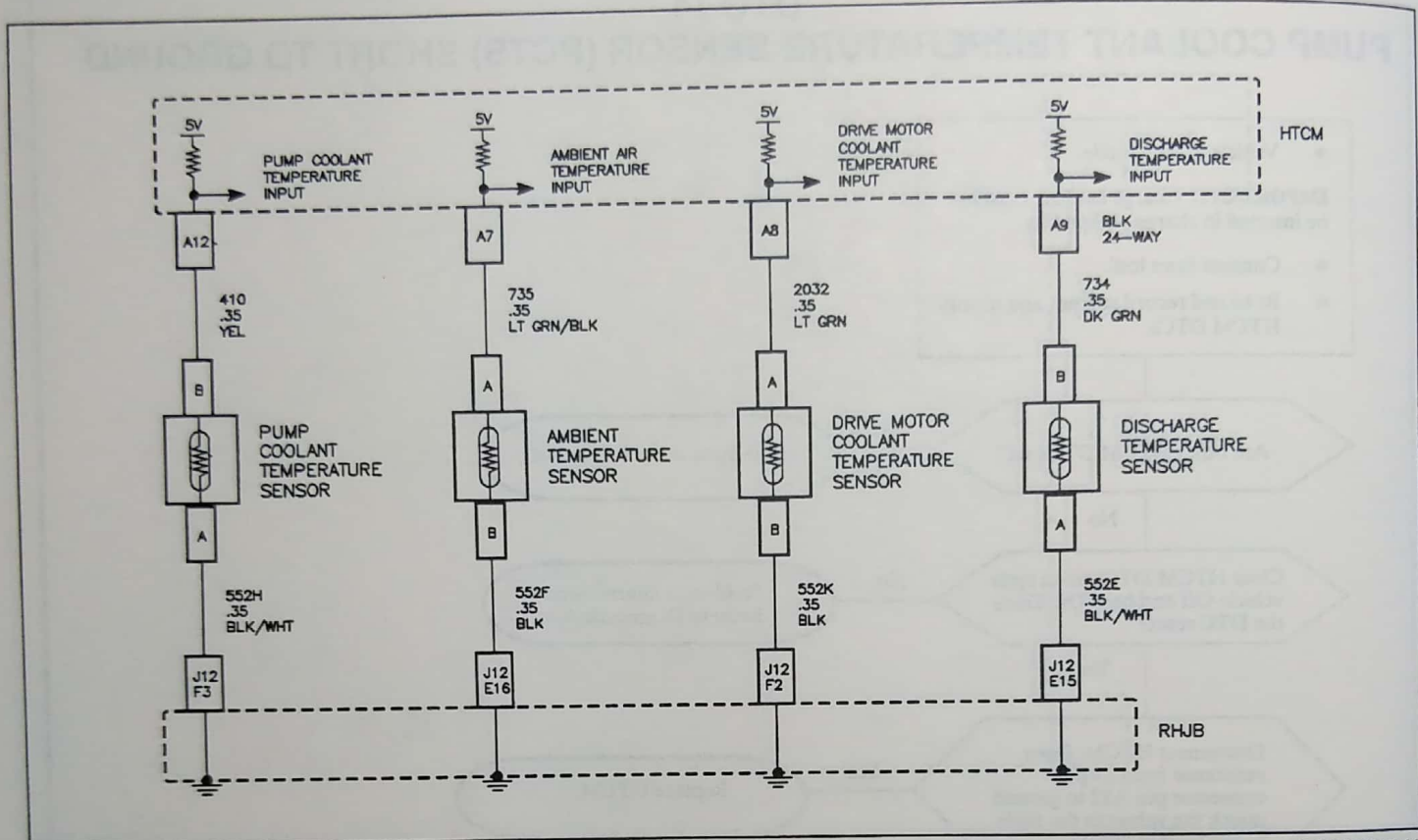
- Check for short to ground in circuit 410 between sensor and HTCM.
- If circuit ok, replace pump coolant temperature sensor.

PUMP COOLANT TEMPERATURE

Temp C° (F°)	Resistance Ohms
-40 (-40)	73.566k – 127.848k
-20 (-4)	21.900k – 35.455k
0 (32)	7.448k – 11.398k
10 (50)	4.556k – 6.788k
20 (68)	3108 – 3922
30 (86)	1993 – 2482
35 (95)	1611 – 1993
40 (104)	1309 – 1610
45 (113)	1069 – 1308
50 (122)	877.9 – 1068
55 (131)	727.6 – 880
60 (140)	605.9 – 728.9
65 (149)	507 – 606.8
70 (158)	426 – 507.5
80 (176)	304.7 – 359.7
90 (194)	221.4 – 259.2
100 (212)	163.3 – 189.6
140 (284)	53.95 – 65.69



DTC 15 – DISCHARGE TEMPERATURE SENSOR (DTS) SHORT TO GROUND



PSMELC68181AA

DISCHARGE TEMPERATURE SENSOR (DTS) SHORT TO GROUND

The temperature sensors are thermistors that change resistance with temperature change. The sensors have higher resistance as they get colder, lower resistance as temperatures increase. The HPVS/thermal control module (HTCM) provides a five volt signal to the temperature sensors, which ground through the right hand junction block. If the measured input goes outside the normal operating range, this fault will be set.

DTC PARAMETERS

DTC 15 will set if:

- Short to ground in the DTS circuit.
- Faulty sensor.
- HTCM failure.

DTC 15 will set when:

Anytime the HTCM is awake. This fault exists if the HTCM detects input voltage less than 0.06 volts. An open condition cannot be detected because of the overlap between normal operating voltage and open circuit voltage.

FAILURE ACTION

The SERVICE SOON light will be turned On.

RELATED DTCS

None.

TELLTALE ILLUMINATED:

None

OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

Check the tightness of the female terminal grip with a spare male terminal.

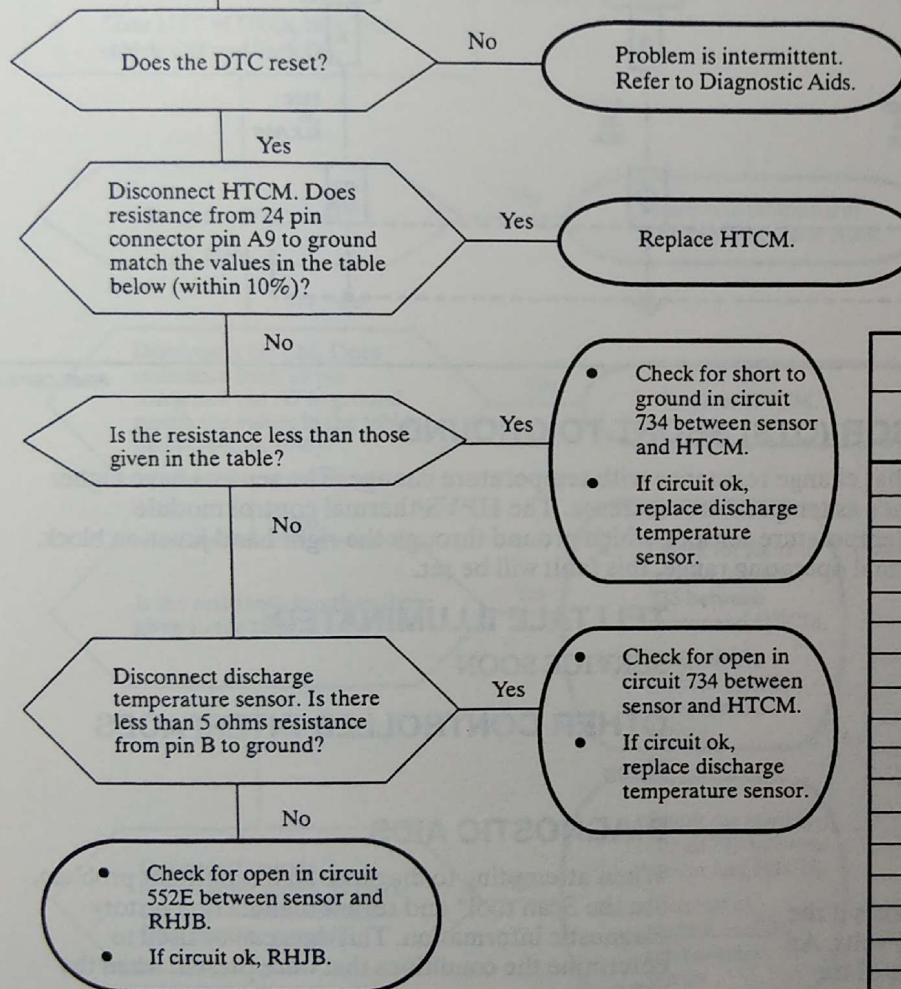
If the problem is intermittent, wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

DTC 15 DISCHARGE TEMPERATURE SENSOR (DTS) SHORT TO GROUND

- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

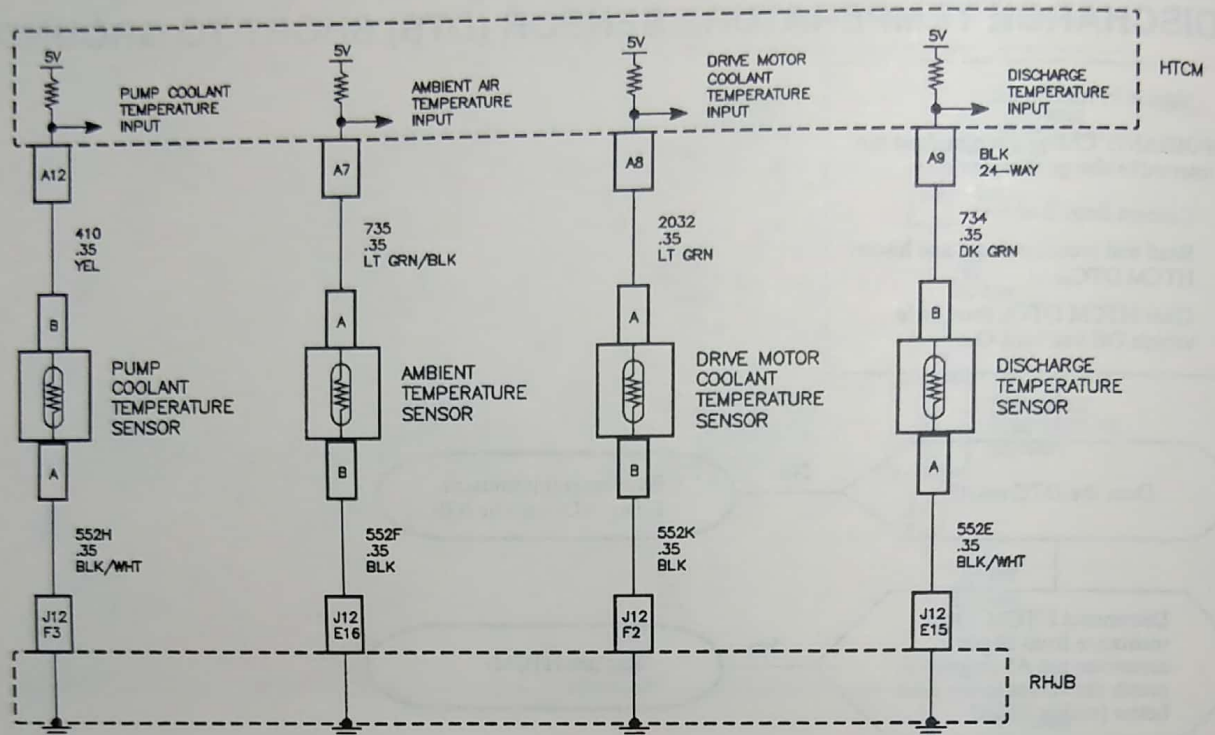
- Connect Scan Tool.
- Read and record current and history HTCM DTCs.
- Clear HTCM DTCs, then cycle vehicle Off and back On.



DISCHARGE AIR TEMPERATURE

Temp C° (F°)	Resistance Ohms
-40 (-40)	94.004k - 107.3970k
-35 (-31)	6.7891k - 77.006k
-30 (-22)	49.547k - 55.794k
-25 (-13)	36.517k - 40.826k
-20 (-4)	27.164k - 30.157k
-15 (5)	20.384k - 22.476k
-10 (14)	15.428k - 16.890k
-5 (23)	11.765k - 12.800k
0 (32)	9.039k - 9.775k
5 (41)	7.009k - 7.536k
10 (50)	5.477k - 5.856k
15 (59)	4.310k - 4.583k
20 (68)	3416 - 3612
25 (77)	2725 - 2865
30 (86)	2175 - 2299
35 (95)	1746 - 1857
40 (104)	1410 - 1508
45 (113)	1145 - 1231
50 (122)	935 - 1010
55 (131)	770 - 836
60 (140)	638 - 696
65 (149)	531 - 582
70 (158)	444 - 489
75 (167)	373 - 412
80 (176)	315 - 349
85 (185)	267 - 297

DTC 16 – OUTSIDE TEMPERATURE SENSOR (OTS) SHORT TO GROUND



PSMELC68181AA

OUTSIDE TEMPERATURE SENSOR (OTS) SHORT TO GROUND

The temperature sensors are thermistors that change resistance with temperature change. The sensors have higher resistance as they get colder, lower resistance as temperatures increase. The HPVS/thermal control module (HTCM) provides a five volt signal to the temperature sensors, which ground through the right hand junction block. If the measured input goes outside the normal operating range, this fault will be set.

DTC PARAMETERS

DTC 16 will set if:

- Short to ground in the OTS circuit.
- Faulty sensor.
- HTCM failure.

DTC 16 will set when:

Anytime the HTCM is awake. This fault exists if the HTCM detects input voltage less than 0.06 volts. An open condition cannot be detected because of the overlap between normal operating voltage and open circuit voltage.

FAILURE ACTION

The SERVICE SOON light will be turned On. Compressor will operate in either heat or cool mode regardless of ambient temperature.

RELATED DTCS

HTCM 52.

TELLTALE ILLUMINATED:

SERVICE SOON

OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

When attempting to diagnose an intermittent problem, use the Scan tool* and review malfunction history diagnostic information. This data can be used to determine the conditions that were present when the DTC set.

*Select Malf History from the Scan tool HTCM menu.

Check the tightness of the female terminal grip with a spare male terminal.

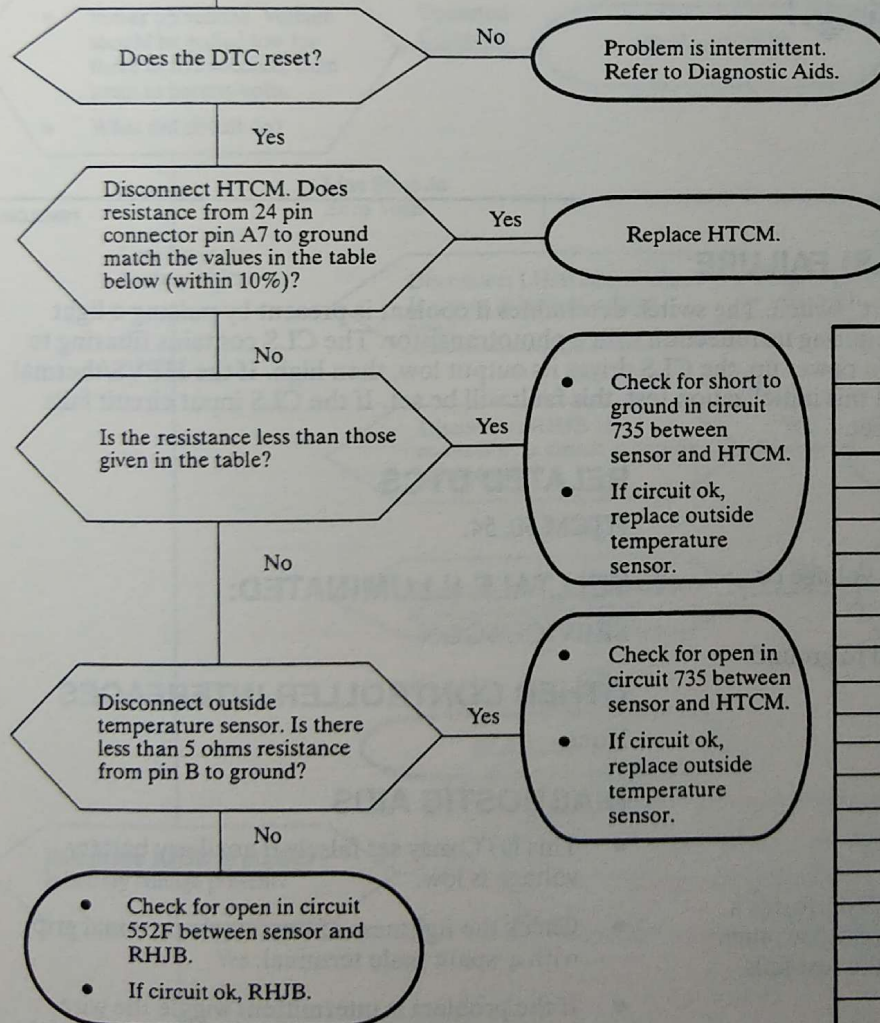
If the problem is intermittent, wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

DTC 16 OUTSIDE TEMPERATURE SENSOR (OTS) SHORT TO GROUND

- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

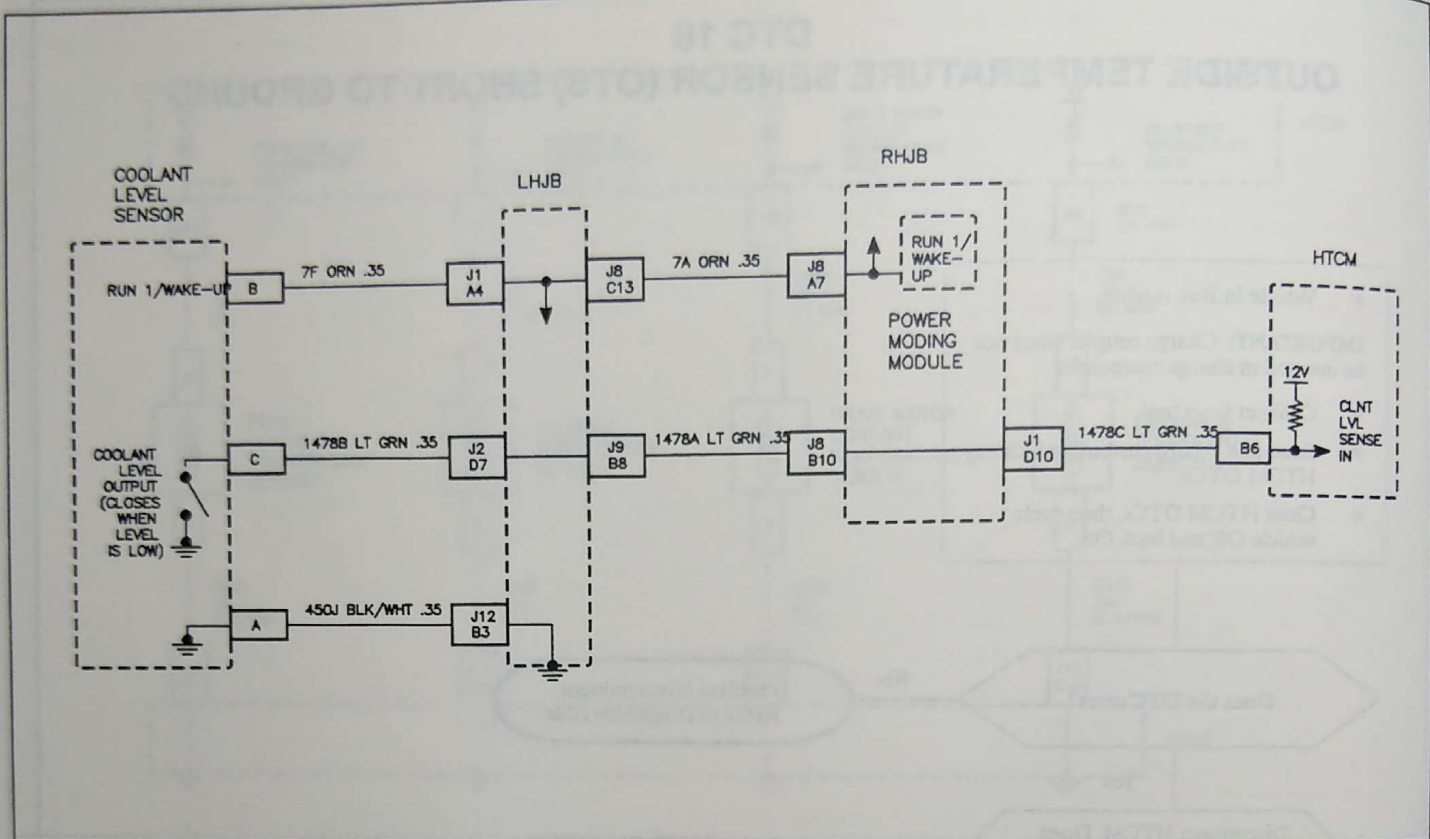
- Connect Scan tool.
- Read and record current and history HTCM DTCs.
- Clear HTCM DTCs, then cycle vehicle Off and back On.



OUTSIDE AIR TEMPERATURE

Temp C° (F°)	Resistance Ohms
-40 (-40)	31.1668k - 38.2120k
-35 (-31)	22.6390k - 27.4035k
-30 (-22)	16.6115k - 19.8505k
-25 (-13)	12.3056k - 14.5166k
-20 (-4)	9.1987k - 10.7120k
-15 (5)	6.9354k - 7.9724k
-10 (14)	5.2716k - 5.9819k
-5 (23)	4.0381k - 4.5231k
0 (32)	31160 - 34454
5 (41)	24329 - 26630
10 (50)	19147 - 20747
15 (59)	15183 - 16286
20 (68)	12125 - 12876
25 (77)	9750 - 10250
30 (86)	7812 - 8289
35 (95)	6303 - 6749
40 (104)	5119 - 5530
45 (113)	4184 - 4559
50 (122)	3440 - 3780
55 (131)	2845 - 3152
60 (140)	2366 - 2642

DTC 17 – COOLANT LEVEL SWITCH (CLS) FAILURE



PSMELC68182AA

COOLANT LEVEL SWITCH (CLS) FAILURE

The coolant level switch (CLS) is a “smart” switch. The switch determines if coolant is present by pulsing a light emitting diode into the coolant, and monitoring its reflection with a phototransistor. The CLS contains filtering to prevent false detection of low coolant. On power up, the CLS drives its output low, then high. If the HPVS/thermal control module (HTCM) does not detect this initialization test, this fault will be set. If the CLS input circuit fails after startup, an HTCM DTC 54 will be set.

DTC PARAMETERS

DTC 17 will set if:

- CLS input circuit open or shorted to voltage or ground.
- CLS Run one circuit open or shorted to ground.
- CLS ground circuit open.
- Faulty coolant level switch.
- HTCM failure.

DTC 17 will set when:

When the vehicle is powered up. The CLS performs a powerup initialization test, pulling the circuit low, then high. If the HTCM does not detect this, the test fails and this fault will be logged.

FAILURE ACTION

The SERVICE SOON light will be turned On for the duration of the power cycle and the diagnostic for HTCM DTC 54 (low coolant level) is disabled.

RELATED DTCS

HTCM 50, 54.

TELLTALE ILLUMINATED:

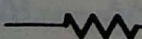
SERVICE SOON

OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

- This DTC may set falsely if auxiliary battery voltage is low.
- Check the tightness of the female terminal grip with a spare male terminal.
- If the problem is intermittent wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.



DTC 17 COOLANT LEVEL SWITCH (CLS) FAILURE

- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record current and history HTCM DTCs.
- Clear HTCM DTCs, then cycle vehicle Off and back On.

Does the DTC reset?

No

Problem is intermittent. Refer to Diagnostic Aids.

Yes

- Backprobe HTCM pin B8.
- Power up vehicle. Voltage should be pulled low for three to five seconds, then jump to battery volts.
- What did circuit do?

Operated Correctly

Replace HTCM.

Line Stays At Zero Volts

Line Stays At Battery Volts

Disconnect LHJB J2 connector. Is circuit at battery voltage now?

Yes

- Check circuit 1478B for short to ground.
- If circuit ok, replace coolant level switch.

No

Disconnect RHJB J8 connector. Is circuit at battery voltage now?

Yes

- Check circuit 1478A for short to ground.
- If circuit ok, replace LHJB.

No

Disconnect HTCM. Is pin B6 showing short to ground?

Yes

- Check circuit 1478C for short to ground.
- If circuit ok, replace RHJB.

No

Replace HTCM.

Backprobe RHJB J8 pin B10 - is battery voltage present?

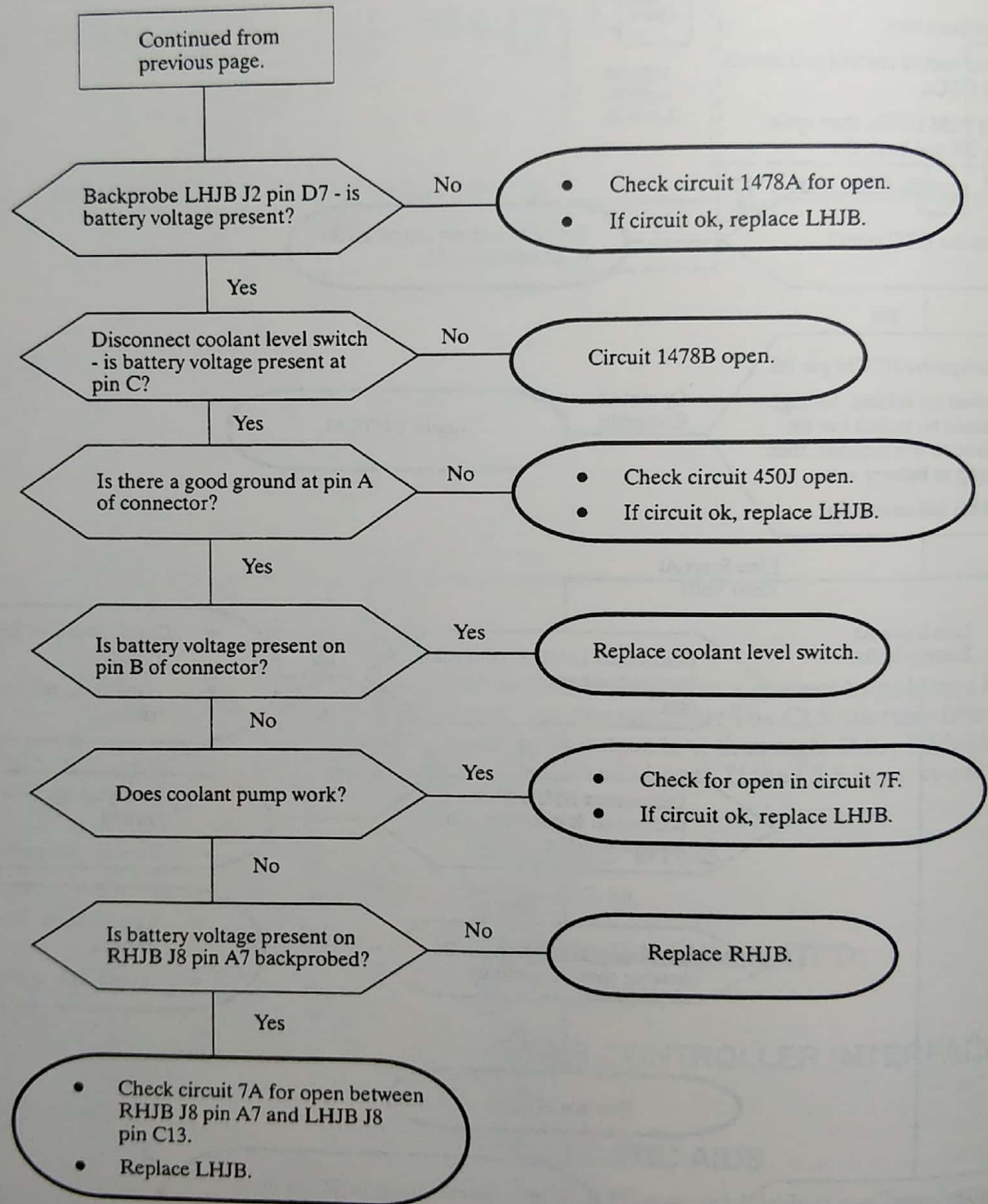
No

- Check circuit 1478C for open.
- If circuit ok, replace RHJB.

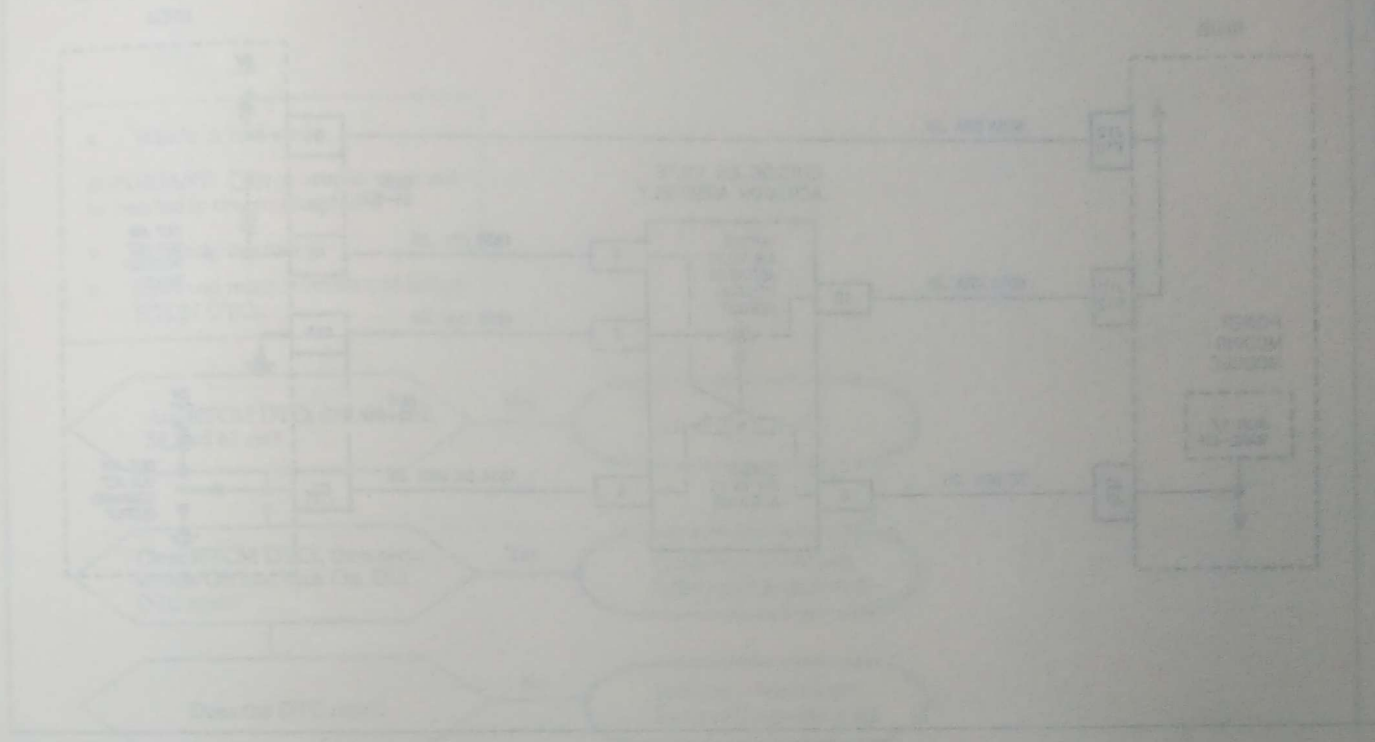
Yes

Go to next page.

DTC 17 COOLANT LEVEL SWITCH (CLS) FAILURE (CONTINUED)



NOTES



OUTSIDE AIR VALVE ACTUATOR (OAV) FEEDBACK OPEN SHORT

The OAV feedback switch is a normally closed switch that is used to indicate the position of the OAV. If the OAV is open, the switch will be closed, and the feedback signal will be sent to the controller. If the OAV is closed, the switch will be open, and no feedback signal will be sent.

RELATED DTCS

DTCM 10, 11, 12, 13, 14

TEST LAMP ILLUMINATED

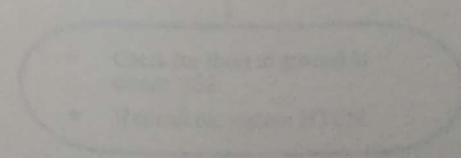
None

OTHER CONTROLLER INTERFACES

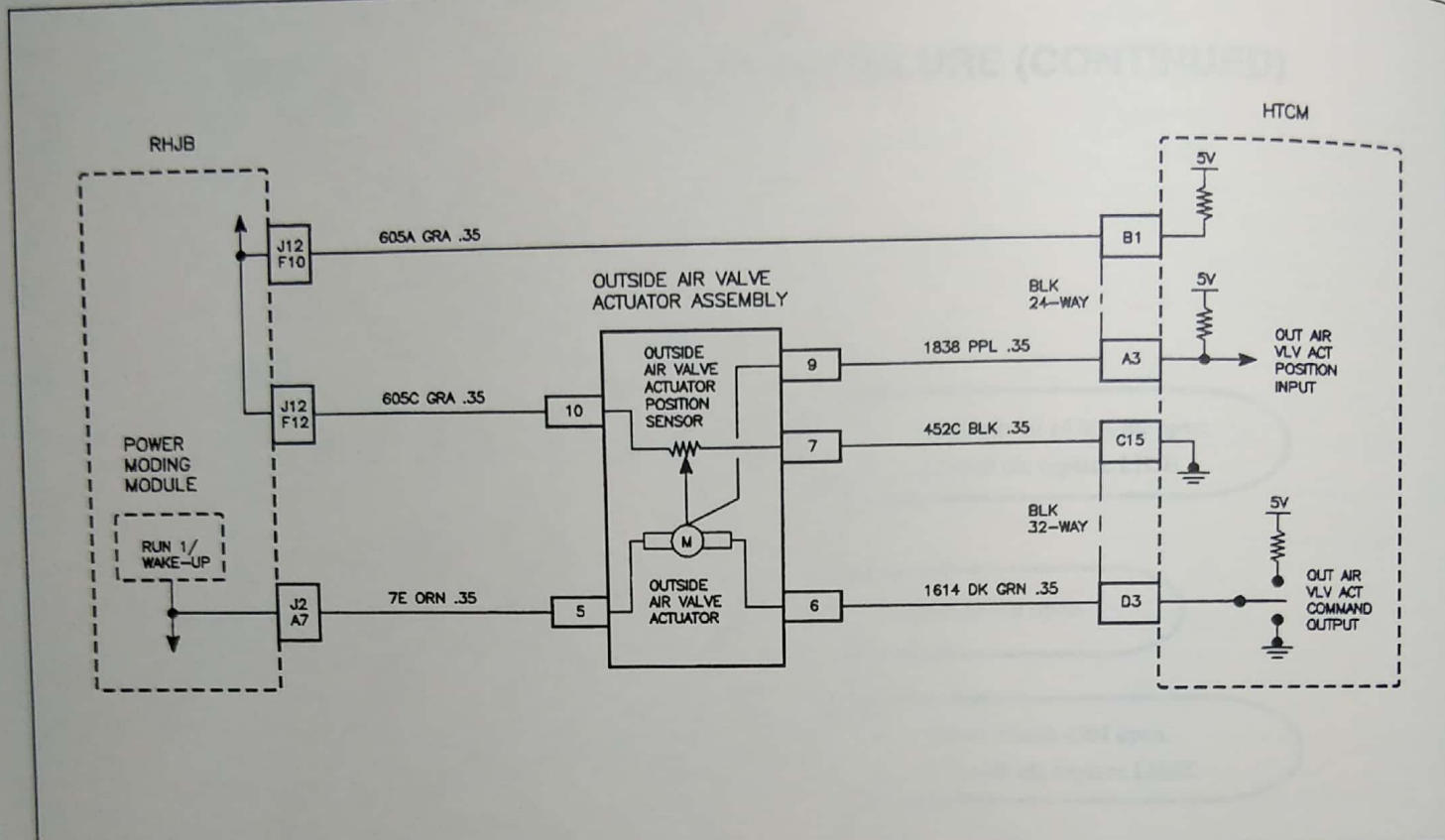
None

DIAGNOSTIC AIDS

Check the operation of the OAV feedback switch. If the switch is not working, the OAV may not be opening properly. Check the wiring between the switch and the controller. If the wiring is not correct, the feedback signal will not be sent.



DTC 18 – OUTSIDE AIR VALVE ACTUATOR (OAV) FEEDBACK OPEN/SHORT



PSMELC68183AA

OUTSIDE AIR VALVE ACTUATOR (OAV) FEEDBACK OPEN/SHORT

The door actuator position is monitored by the HPVS/thermal control module (HTCM) via a feedback circuit. If a fault is detected on the feedback input circuit, this fault will be set.

DTC PARAMETERS

DTC 18 will set if:

- Open or short to ground or voltage in the outside air valve (OAV) door feedback circuit.
- Faulty OAV actuator.
- HTCM failure.

DTC 18 will set when:

Anytime the HTCM is awake. This fault exists if the HTCM detects less than 0.06 volts or more than 4.88 volts on the feedback input circuit.

FAILURE ACTION

This DTC will be logged.

RELATED DTCS

HTCM 10, 11, 22, 58, 62.

TELLTALE ILLUMINATED:

None

OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

Check the tightness of the female terminal grip with a spare male terminal.

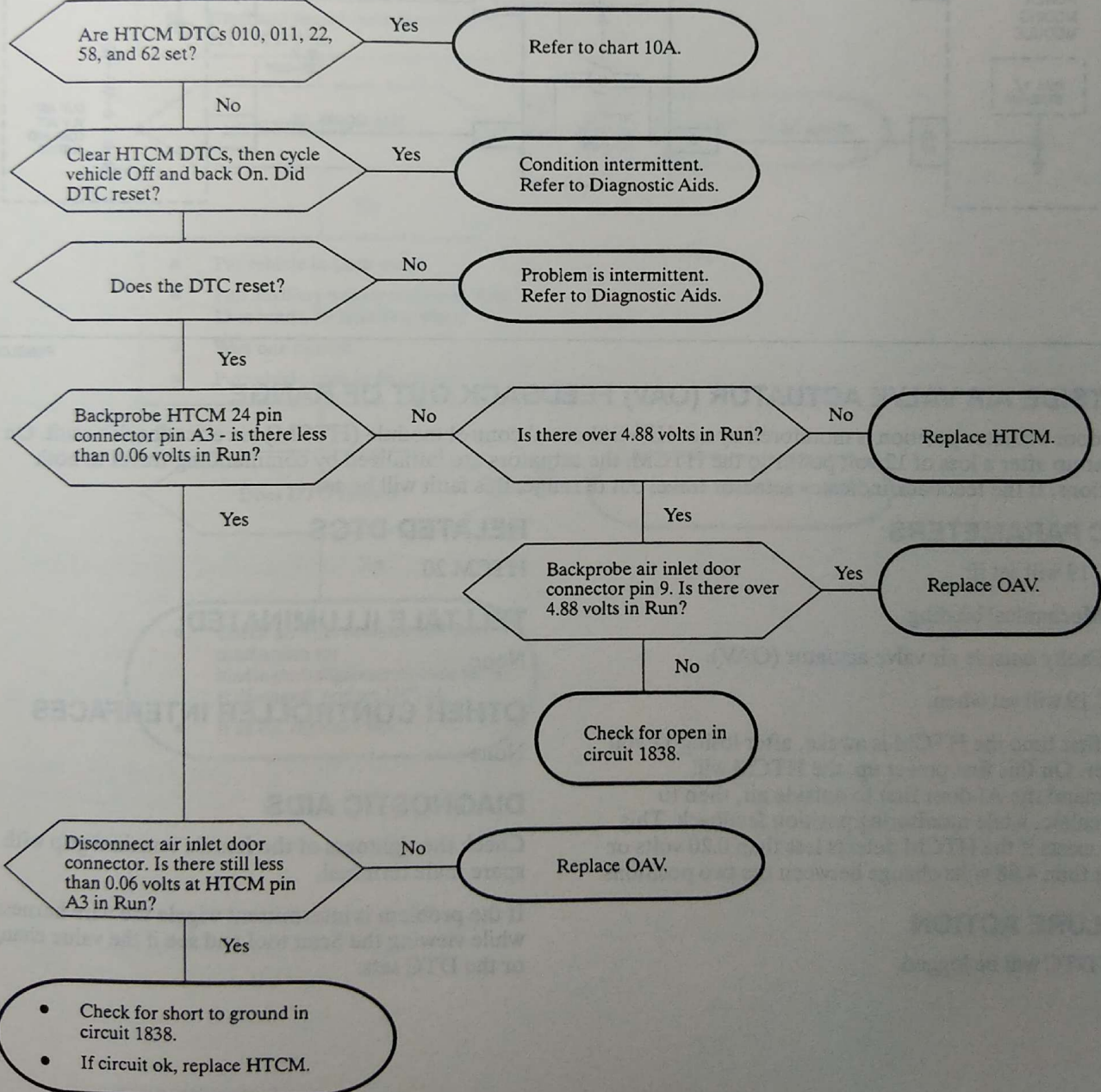
If the problem is intermittent wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

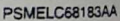
DTC 18 OUTSIDE AIR VALVE ACTUATOR (OAV) FEEDBACK OPEN/SHORT

- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record current and history HTCM DTCs.





The door actuator position is monitored by the HPVS/thermal control module (HTCM) via a feedback circuit. On power up after a loss of 12 volt power to the HTCM, the actuators are initialized by commanding travel to both positions. If the feedback indicates actuator travel out of range, this fault will be set.

DTC 19 will set if:

- DTC 19 will set when:

FAILURE ACTION

RELATED DTCS

HTCM 20

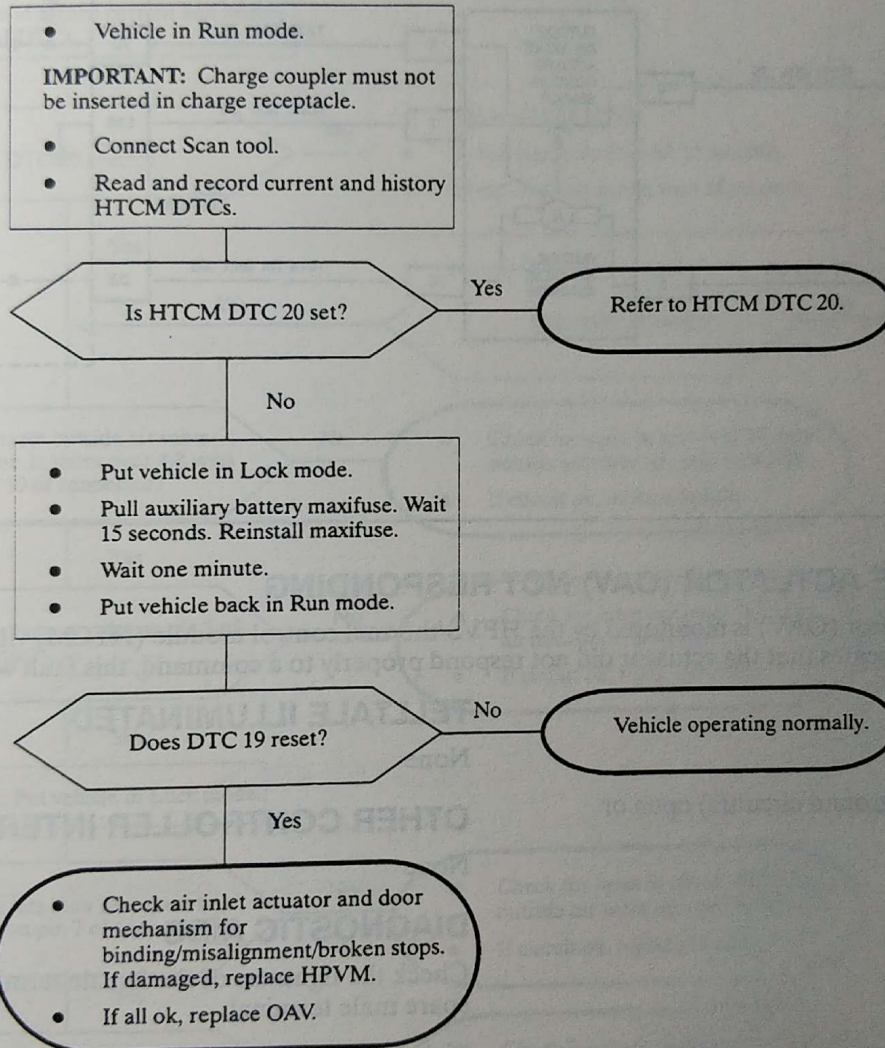
None

None

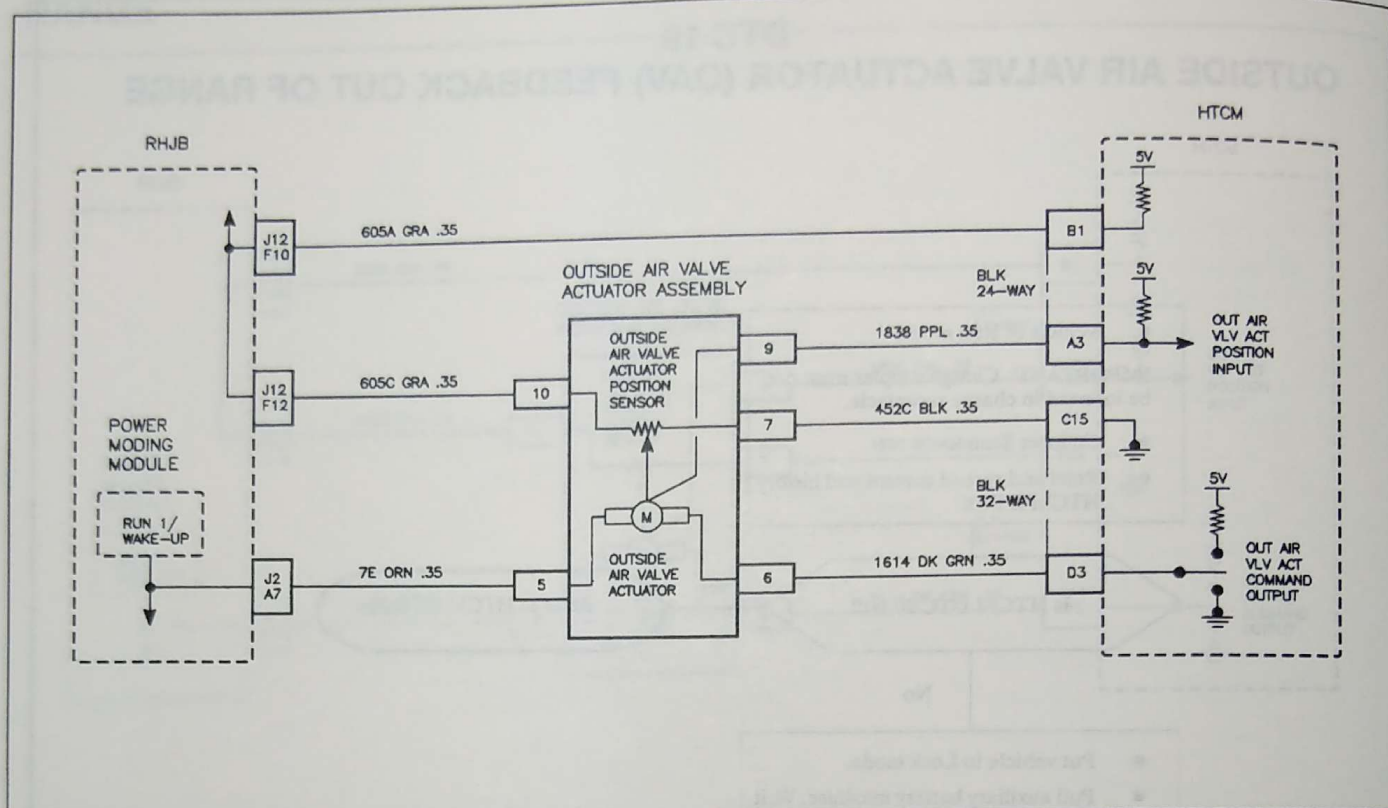
Check the tightness of the female terminal grip with a spare male terminal.

If the problem is intermittent wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

DTC 19 OUTSIDE AIR VALVE ACTUATOR (OAV) FEEDBACK OUT OF RANGE



DTC 20 – OUTSIDE AIR VALVE ACTUATOR (OAV) NOT RESPONDING



PSMELC68183AA

OUTSIDE AIR VALVE ACTUATOR (OAV) NOT RESPONDING

The outside air valve actuator (OAV) is monitored by the HPVS/thermal control module (HTCM) via a feedback circuit. If the feedback indicates that the actuator did not respond properly to a command, this fault will be set.

DTC PARAMETERS

DTC 20 will set if:

- OAV actuator power/ground circuit(s) open or shorted to ground.
- Mechanical binding.
- HTCM failure.
- Faulty OAV actuator.

DTC 20 will set when:

Anytime the OAV feedback indicates that the OAV door did not reach the commanded position.

FAILURE ACTION

This DTC will be logged.

RELATED DTCS

HTCM 18, 19.

TELLTALE ILLUMINATED:

None

OTHER CONTROLLER INTERFACES

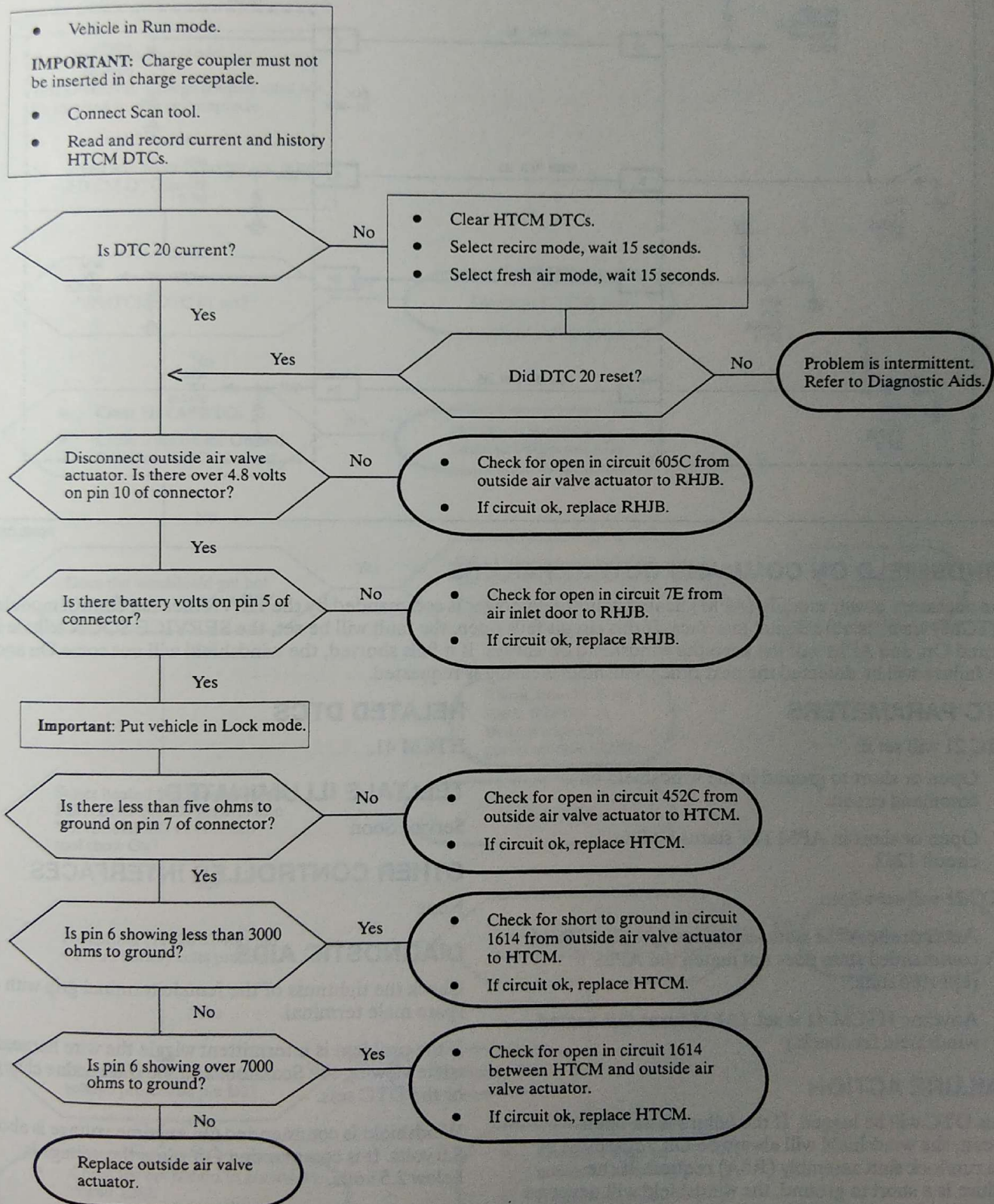
None

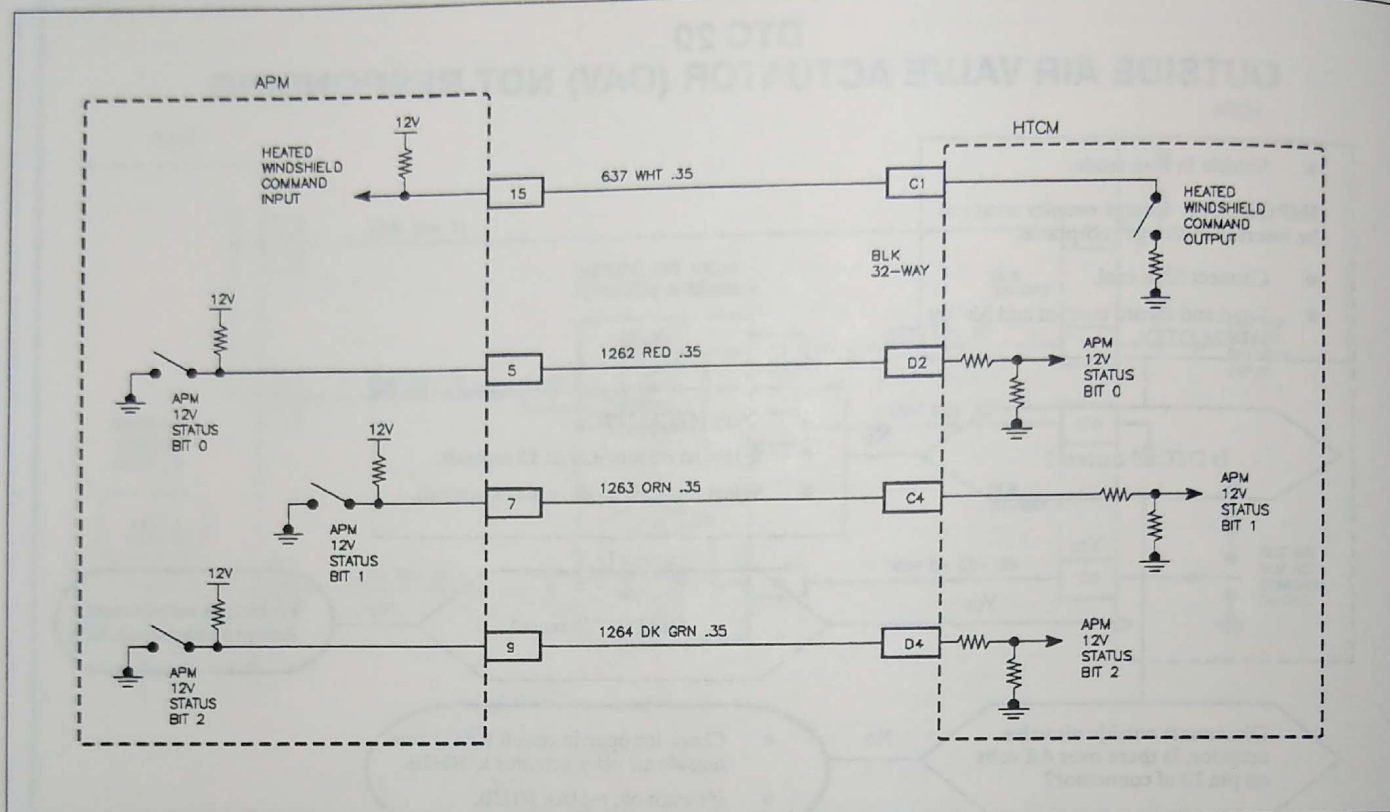
DIAGNOSTIC AIDS

Check the tightness of the female terminal grip with a spare male terminal.

If the problem is intermittent wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

DTC 20 OUTSIDE AIR VALVE ACTUATOR (OAV) NOT RESPONDING



DTC 21 – WINDSHIELD ON COMMAND OUTPUT FAILURE

PSMELC68184AC

WINDSHIELD ON COMMAND OUTPUT FAILURE

The accessory power module (APM) heated windshield power is commanded by the HPVS/thermal control module (HTCM) via a discrete digital interface. If this circuit fails open, the fault will be set, the SERVICE SOON telltale is turned On, and APM will keep the windshield on always. If it fails shorted, the windshield will not come On and the failure will be detected the next time windshield clearing is requested.

DTC PARAMETERS

DTC 21 will set if:

- Open or short to ground in the windshield on command circuit.
- Open or short in APM 12V status bit 0 circuit 1262.

DTC 21 will set when:

- Anytime the APM status indicates that the HTCM commanded state does not match the APM reported state.
- Anytime HTCM 41 is set. (APM turns Off heated windshield feedback.)

FAILURE ACTION

This DTC will be logged. If the failure is an open circuit, the windshield will always be On, regardless of the run/lock shift assembly (RSA) request. If the failure is a short to ground, the windshield will never be On, regardless of the RSA request.

RELATED DTCS

HTCM 41.

TELLTALE ILLUMINATED:

Service Soon

OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

Check the tightness of the female terminal grip with a spare male terminal.

If the problem is intermittent wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

Windshield is commanded On anytime voltage is above 8.0 volts. It is commanded Off when the voltage is below 2.5 volts.



DTC 21 WINDSHIELD ON COMMAND OUTPUT FAILURE

- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record current and history HTCM DTCs.

Is HTCM DTC 41 set?

Yes

Diagnose DTC 41 first.

No

- Clear HTCM DTCs.
- Cycle front de-ice On and Off. Does DTC 21 reset?

No

Problem is intermittent. Refer to Diagnostic Aids.

No

Does the windshield get hot even when commanded Off?

Yes

Select heated windshield Off on the RSA. Backprobe HTCM 32-way pin C1. Are battery volts present?

Yes

Replace HTCM.

No

No

Check circuit 637 for open. If circuit ok, replace accessory power module (APM).

Select heated windshield On on RSA. Does HTCM general info WINDSHIELD CMD Scan tool show On?

No

Replace RSA.

Yes

Backprobe HTCM 32-way pin C1. Are battery volts present?

No

Disconnect HTCM. Is there battery voltage on pin C1 now?

Yes

Replace HTCM.

Yes

Disconnect HTCM. Is battery voltage present on pin D2?

Yes

Replace HTCM.

No

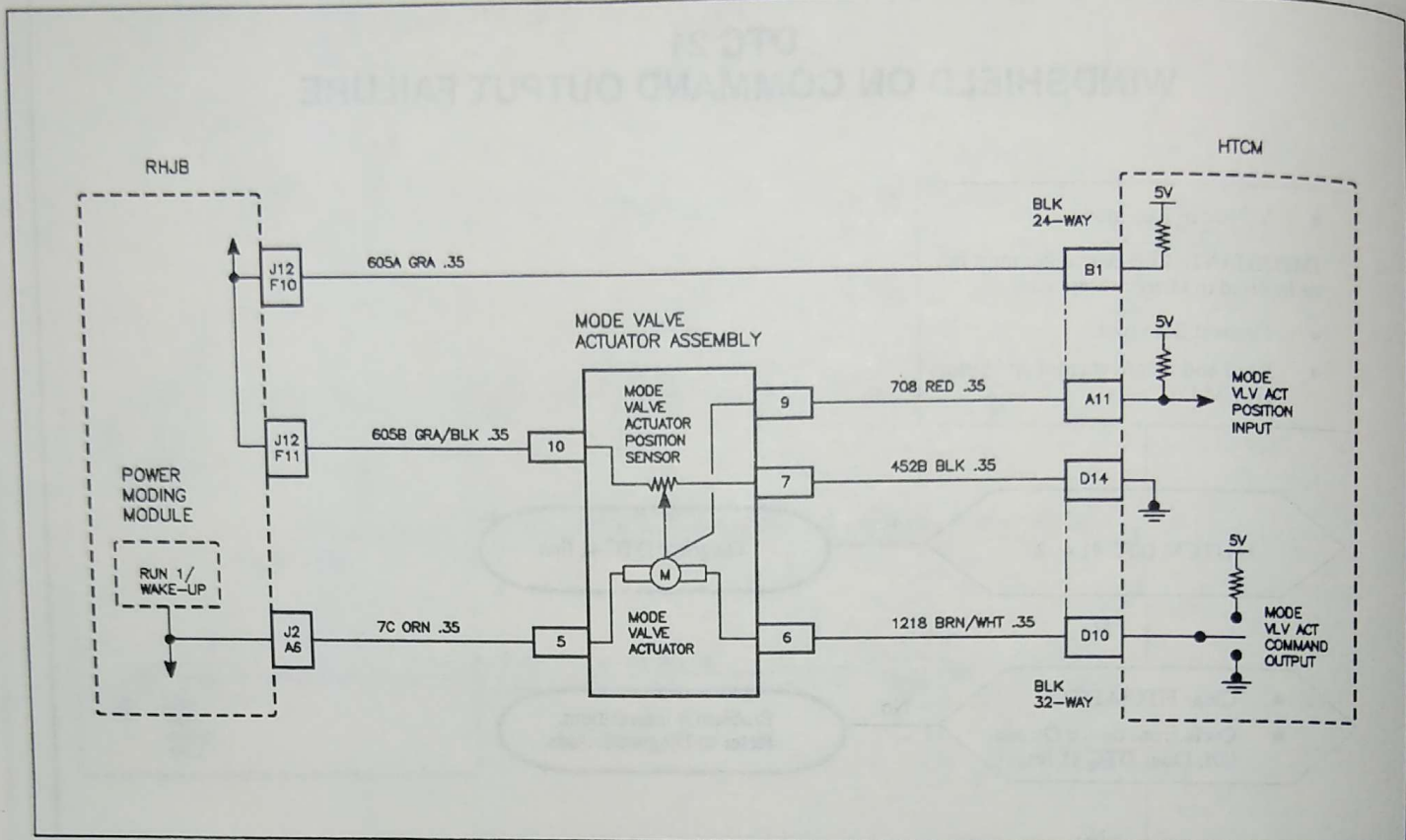
No

- Check for open/short to ground on circuit 1262.
- If circuit ok, replace APM.

- Check for short to ground in circuit 637.
- If circuit ok, replace APM.



DTC 22 – MODE VALVE ACTUATOR FEEDBACK OPEN/SHORT



PSMELC68185AA

MODE VALVE ACTUATOR FEEDBACK OPEN/SHORT

The mode valve actuator position is monitored by the HPVS/thermal control module (HTCM) via a feedback circuit. If a fault is detected on the feedback input circuit, this fault will be set.

DTC PARAMETERS

DTC 22 will set if:

- Open or short to ground or voltage in the mode valve feedback circuit.
- Faulty mode valve actuator.
- HTC/M failure.

DTC 22 will set when:

Anytime the HTC/M is awake. This fault exists if the HTC/M detects less than 0.06 volts or more than 4.88 volts on the feedback input circuit.

FAILURE ACTION

This DTC will be logged.

RELATED DTCS

HTCM 10, 11, 18, 58, 62.

TELLTALE ILLUMINATED:

None

OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

Check the tightness of the female terminal grip with a spare male terminal.

If the problem is intermittent wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

DTC 22 MODE VALVE ACTUATOR FEEDBACK OPEN/SHORT

- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record current and history HTCM DTCs.

Are HTCM DTCs 11, 18, 58, and 62 set?

Yes

Go to Chart 10A.

No

Clear HTCM DTCs, then cycle vehicle Off and back On. Does the DTC reset?

No

Problem is intermittent. Refer to Diagnostic Aids.

Yes

Backprobe HTCM 24 pin connector pin A11 - is there less than 0.06 volts in Run?

No

Is there over 4.88 volts in Run?

No

Replace HTCM.

Yes

Backprobe air mode valve connector pin 9. Is there over 4.88 volts in Run?

Yes

Replace mode valve actuator.

No

Check for open in circuit 708.

Disconnect air mode valve connector. Is there still less than 0.06 volts at HTCM pin A11 in Run?

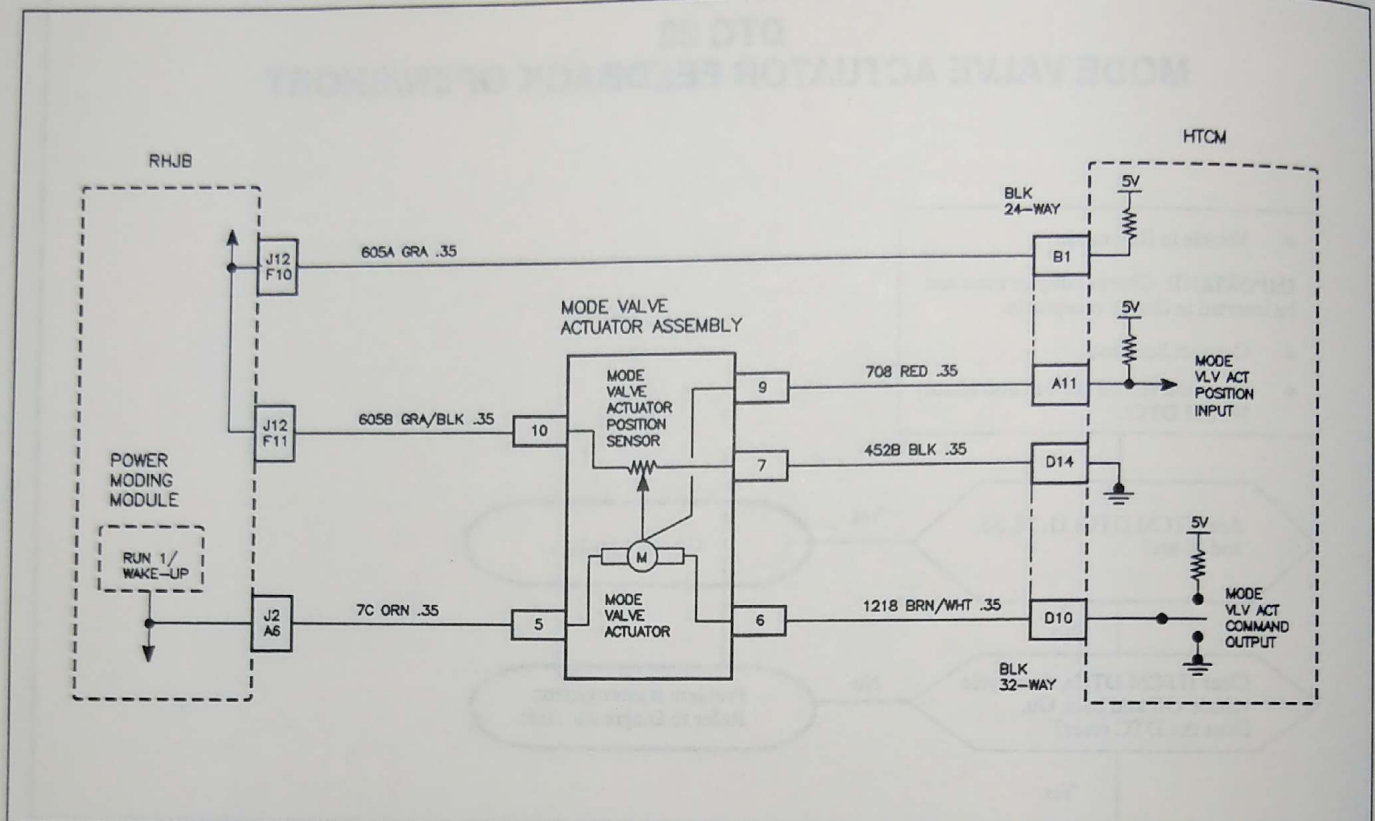
No

Replace mode valve actuator.

Yes

- Check for short to ground in circuit 708.
- If circuit ok, replace HTCM.

DTC 23 – MODE VALVE ACTUATOR FEEDBACK OUT OF RANGE



PSMELC68185AA

MODE VALVE ACTUATOR FEEDBACK OUT OF RANGE

The mode valve actuator position is monitored by the HPVS/thermal control module (HTCM) via a feedback circuit. If the feedback indicates actuator travel out of range, this fault will be set.

DTC PARAMETERS

DTC 23 will set if:

- Mode door actuator power/ground circuit(s) open or shorted to ground.
- Mechanical binding.
- Faulty mode valve actuator.

DTC 23 will set when:

The first time the HTCM is awake, after losing 12 volt power. On this first power up, the HTCM will command the mode valve first to the lower position, then to upper, while monitoring position feedback. This fault exists if the HTCM detects less than 0.20 volts or more than 4.88 volts change between the two positions.

FAILURE ACTION

This DTC will be logged.

RELATED DTCS

HTCM 24.

TELLTALE ILLUMINATED:

None

OTHER CONTROLLER INTERFACES

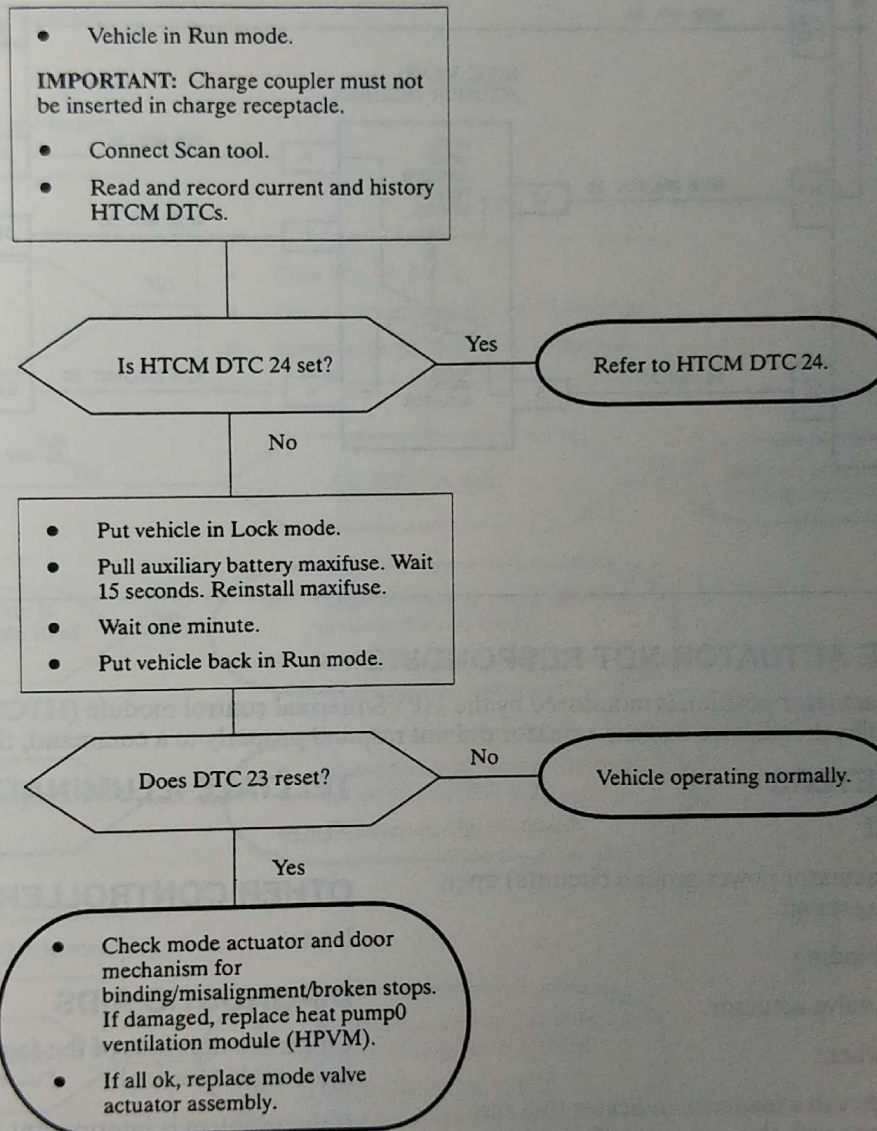
None

DIAGNOSTIC AIDS

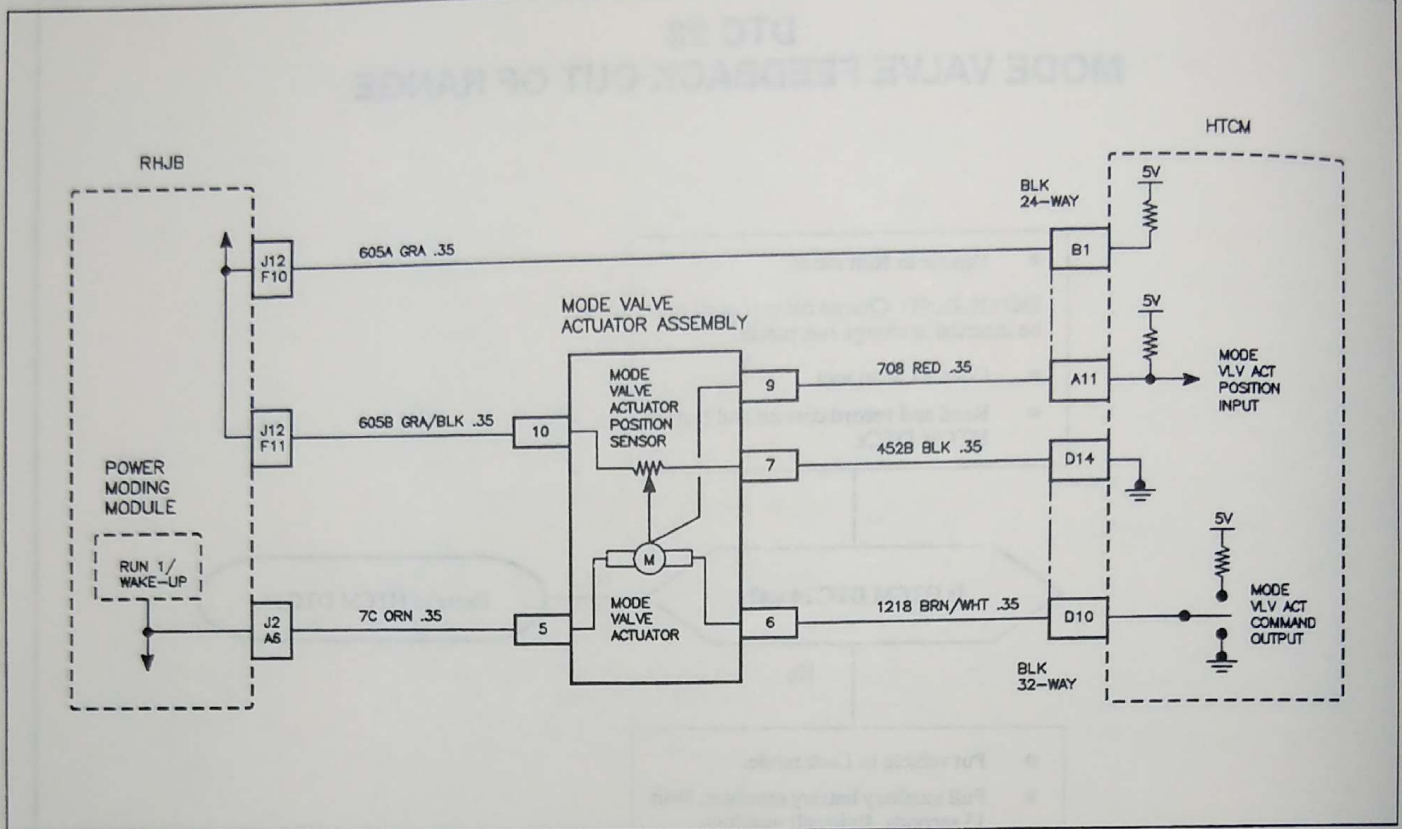
Check the tightness of the female terminal grip with a spare male terminal.

If the problem is intermittent wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

DTC 23 MODE VALVE FEEDBACK OUT OF RANGE



DTC 24 – MODE VALVE ACTUATOR NOT RESPONDING



PSMELC68185AA

MODE VALVE ACTUATOR NOT RESPONDING

The mode valve actuator position is monitored by the HPVS/thermal control module (HTCM) via a feedback circuit. If the feedback indicates that the actuator did not respond properly to a command, this fault will be set.

DTC PARAMETERS

DTC 24 will set if:

- Mode valve actuator power/ground circuit(s) open or shorted to ground.
- Mechanical binding.
- Faulty mode valve actuator.

DTC 24 will set when:

Anytime the mode valve feedback indicates that the mode door did not reach the commanded position.

FAILURE ACTION

This DTC will be logged.

RELATED DTCS

HTCM 22, 23.

TELLTALE ILLUMINATED:

None

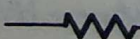
OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

Check the tightness of the female terminal grip with a spare male terminal.

If the problem is intermittent, wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

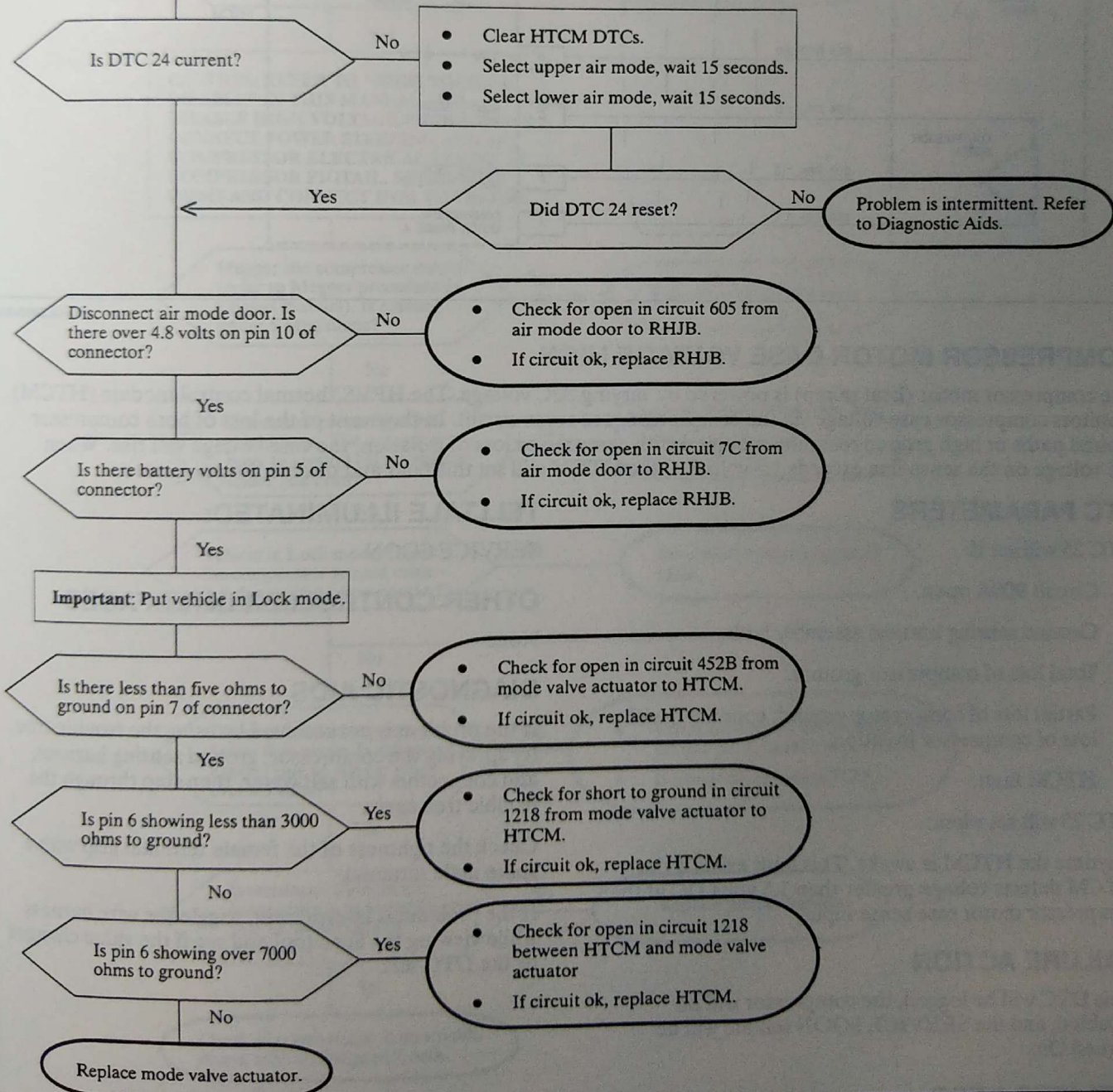


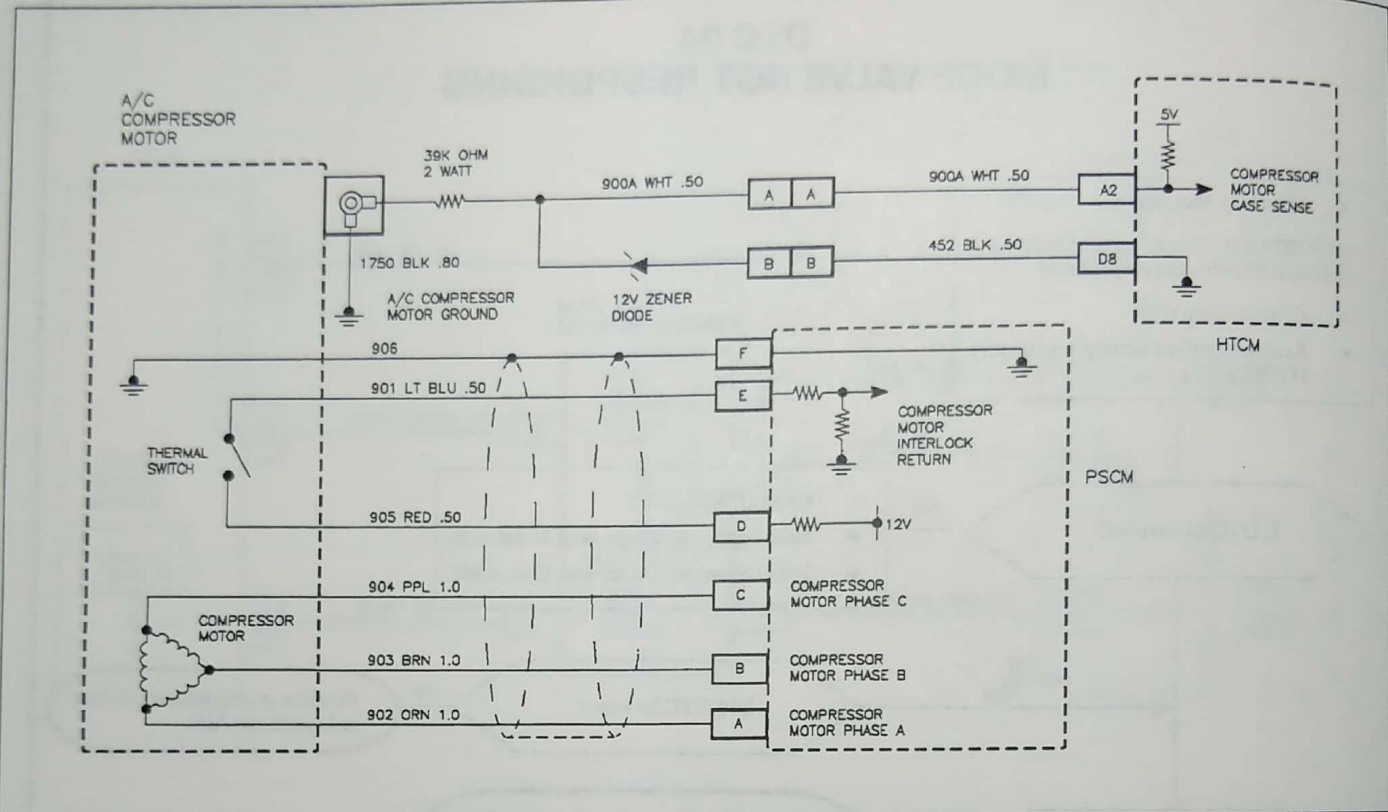
DTC 24 MODE VALVE NOT RESPONDING

- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record current and history HTCM DTCs.



DTC 25 – COMPRESSOR MOTOR CASE VOLTAGE HIGH

PSMELC68343AB

COMPRESSOR MOTOR CASE VOLTAGE HIGH

The compressor motor (heat pump) is powered by varying A/C voltage. The HPVVS/thermal control module (HTCM) monitors compressor case voltage via the compressor case sense circuit. In the event of the loss of both compressor ground paths or high ground resistance coupled with compressor loss of isolation, the case voltage will rise. When the voltage on the sense line exceeds 1.5 volts DC the HTCM will set this fault and disable the compressor.

DTC PARAMETERS

DTC 25 will set if:

- Circuit 900A open.
- Ground sensing harness assembly fault.
- Total loss of compressor ground.
- Partial loss of compressor ground, combined with loss of compressor isolation.
- HTCM fault.

DTC 25 will set when:

Anytime the HTCM is awake. This fault exists if the HTCM detects voltage greater than 1.5 volts DC at the compressor motor case sense input.

FAILURE ACTION

This DTC will be logged, the compressor will be disabled, and the SERVICE SOON telltale will be turned On.

RELATED DTCS

None

TELLTALE ILLUMINATED:

SERVICE SOON

OTHER CONTROLLER INTERFACES

None

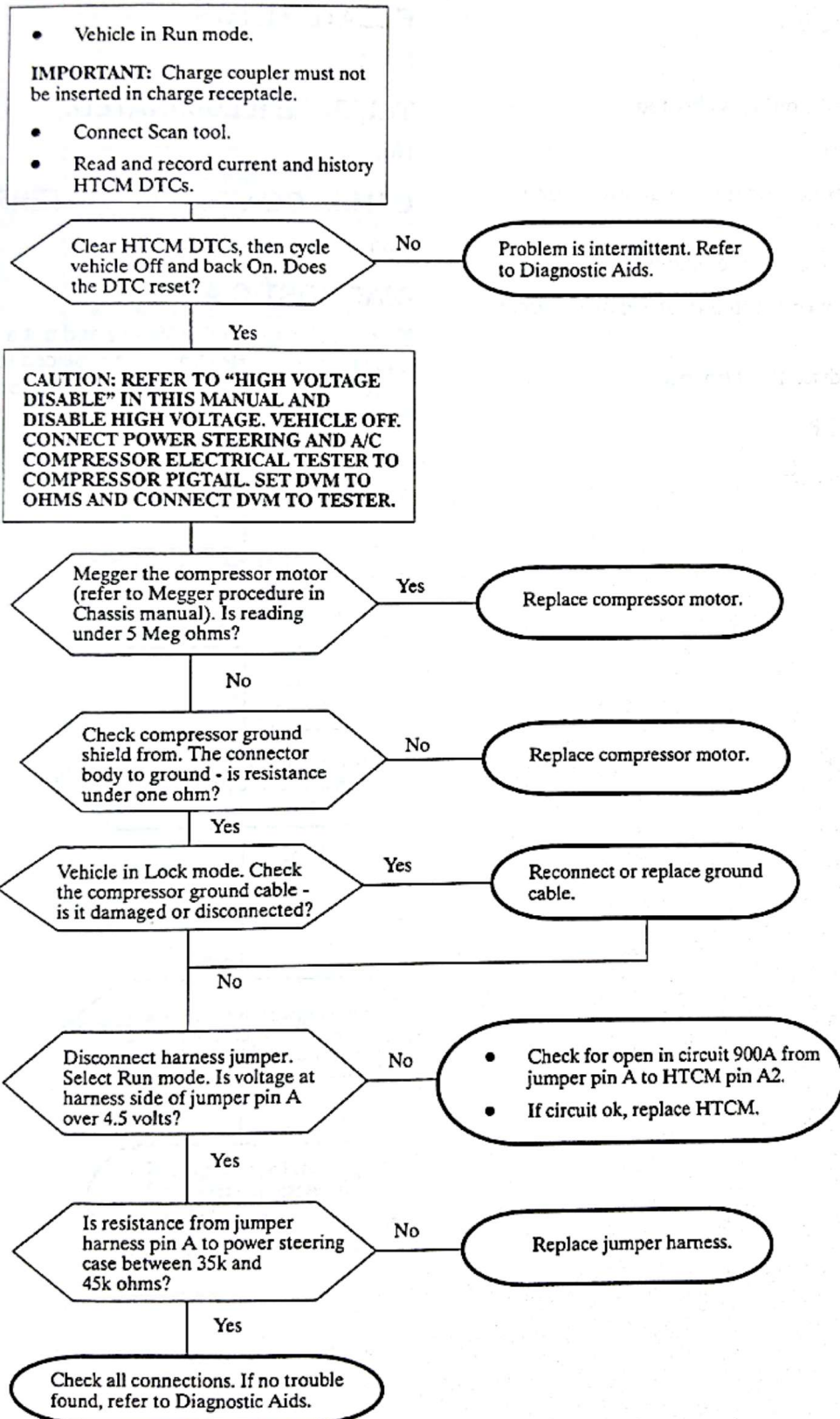
DIAGNOSTIC AIDS

If the problem is not resolved by using the trouble tree, try spraying the compressor, ground sensing harness, and connectors with salt water, then step through the trouble tree again.

Check the tightness of the female terminal grip with a spare male terminal.

If the problem is intermittent, wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

DTC 25 COMPRESSOR MOTOR CASE VOLTAGE HIGH



DTC 26 – PRECONDITIONING ABORTED

When preconditioning is properly set, and a service charge module is connected to the charge receptacle, the HPVS/thermal control module (HTCM) will wake up approximately 15 minutes before the programmed precondition time. The battery pack module will inform the HTCM (via normal mode serial data) if preconditioning was scheduled, but did not take place.

DTC PARAMETERS

DTC 26 will set if:

Anytime that preconditioning is aborted.

DTC 26 will set when:

Preconditioning does not occur (or is aborted) for any of the following reasons:

- Battery pack state of charge below 80%.
- The vehicle is not connected to an service charger module (SCM).
- The automatic disconnect opens.

FAILURE ACTION

This DTC will be logged.

RELATED DTCS

None

TELLTALE ILLUMINATED:

None

OTHER CONTROLLER INTERFACES

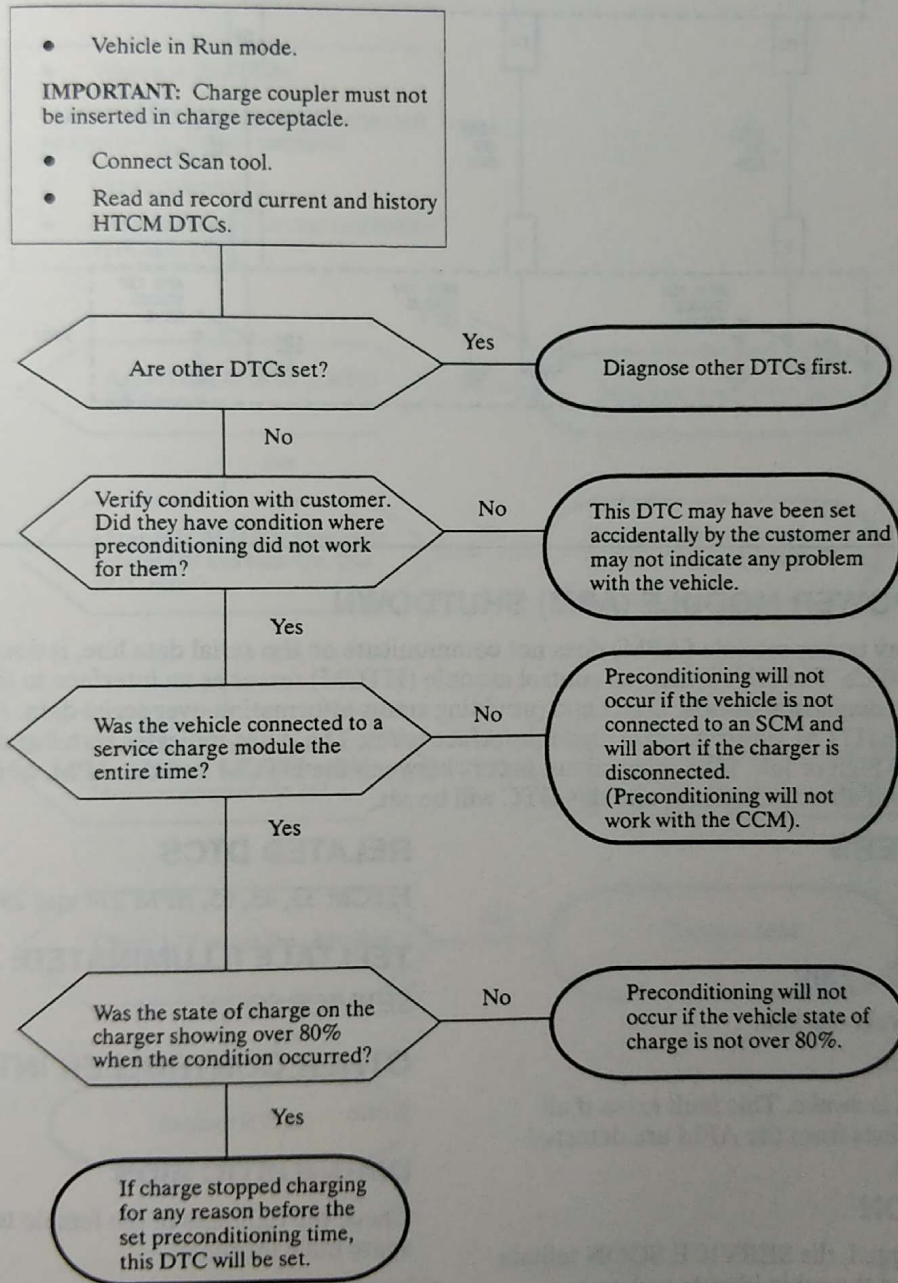
None

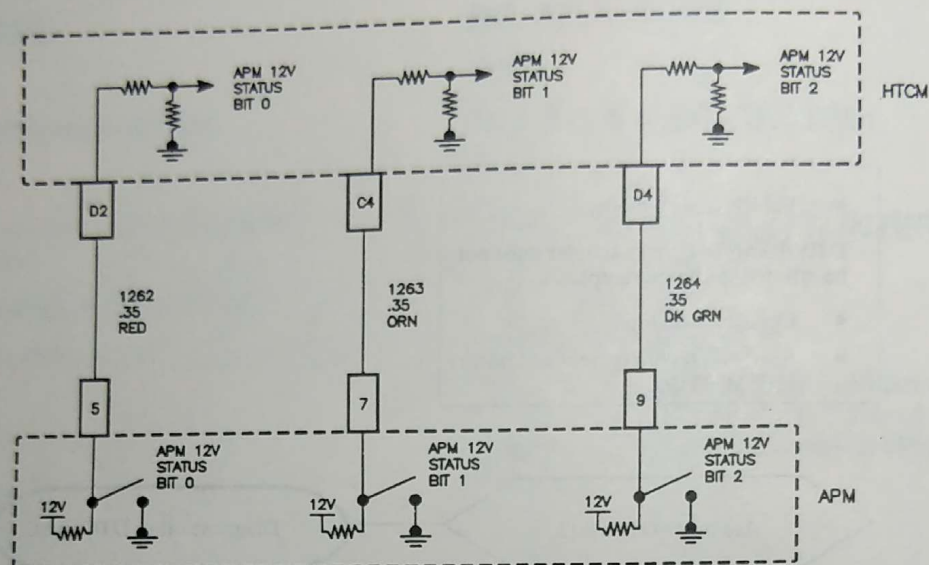
DIAGNOSTIC AIDS

This DTC is a status indicator and not a failure indicator. No parts should be replaced for this DTC. If there is a problem with the vehicle other DTCs should be set.



DTC 26 PRECONDITIONING ABORTED



DTC 27 – ACCESSORY POWER MODULE (APM) SHUTDOWN

PSMELC68185AA

ACCESSORY POWER MODULE (APM) SHUTDOWN

Because the accessory power module (APM) does not communicate on the serial data line, it does not store diagnostic trouble DTCs. The HPVVS/thermal control module (HTCM) serves as an interface to the APM by storing several APM related diagnostic trouble DTCs and providing status information over serial data. APM status is communicated to the HTCM via six discrete digital interface wires. The APM indicates status and fault conditions by driving these lines high or low. If an open circuit occurs between the HTCM and the APM, or if the APM shuts down, these inputs will all be pulled low, and this DTC will be set.

DTC PARAMETERS

DTC 27 will set if:

- APM fault.
- Pack voltage below 220V.
- Loose or open wake-up line.

DTC 27 will set when:

Anytime the HTCM is awake. This fault exists if all three 12 volt status lines from the APM are detected low at the same time.

FAILURE ACTION

This DTC will be logged, the SERVICE SOON telltale will be turned on, and the cabin blower and rear defogger will be disabled. In addition, the failure status will be communicated (via normal mode serial data) to the Battery Pack Module (BPM), which will log a BPM DTC 296, and disable charging.

RELATED DTCS

HTCM 33, 43, 65, BPM 274 and 296.

TELLTALE ILLUMINATED:

SERVICE SOON

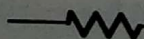
OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

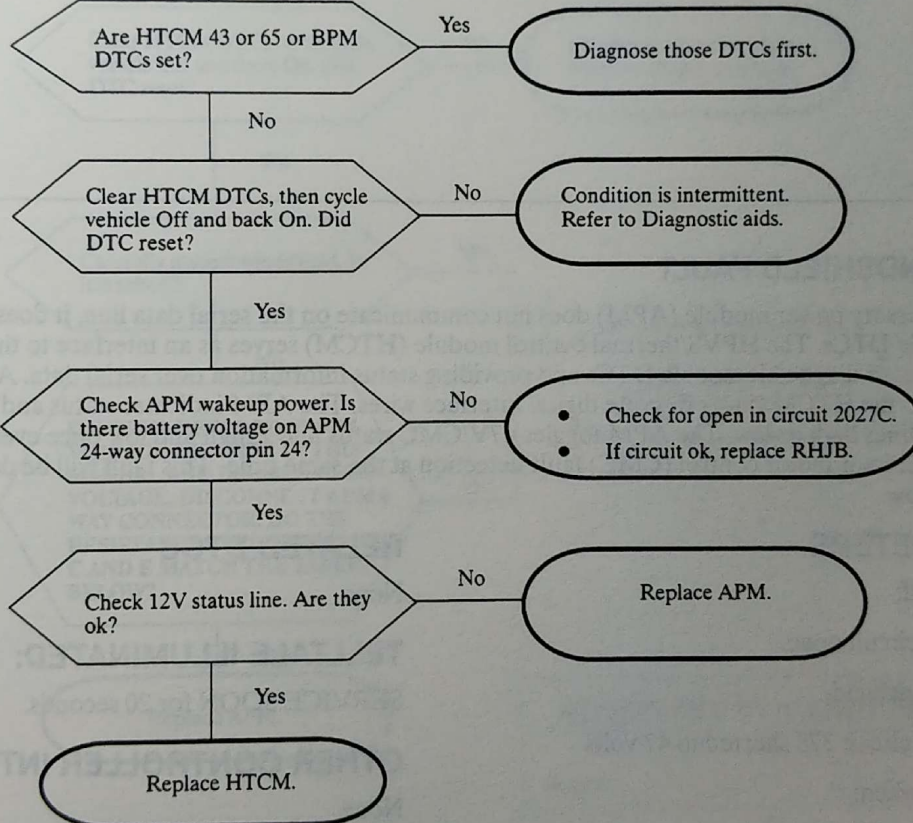
Check the tightness of the female terminal grip with a spare male terminal.

If the problem is intermittent wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

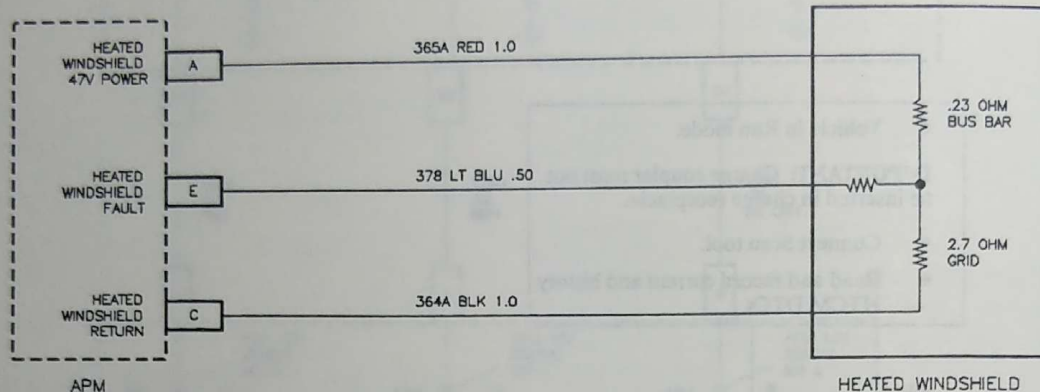


DTC 27 ACCESSORY POWER MODULE (APM) SHUTDOWN

- Vehicle in Run mode.
- IMPORTANT:** Charge coupler must not be inserted in charge receptacle.
- Connect Scan tool.
 - Read and record current and history HTCM DTCs.



DTC 28 – HEATED WINDSHIELD FAULT



PSMELC68344AA

HEATED WINDSHIELD FAULT

Because the accessory power module (APM) does not communicate on the serial data line, it does not store diagnostic trouble DTCs. The HPVS/thermal control module (HTCM) serves as an interface to the APM by storing several APM related diagnostic trouble DTCs and providing status information over serial data. APM status is communicated to the HTCM via six discrete digital interface wires. The APM indicates status and fault conditions by driving these lines high or low. The APM toggles 47V/CMC status line 2 high and low once every second to allow 47 volt and compressor motor control (CMC) fault detection at the same time. This fault will be detected if all three status lines are low.

DTC PARAMETERS

DTC 28 will set if:

- Windshield circuit open.
- Cracked windshield.
- Crack sense circuit 378 shorted to 47 volts.

DTC 28 will set when:

Anytime the HTCM is awake. If either DTC 027 (APM shutdown) or DTC 043 (auto disconnect open) are set, this fault will not set.

FAILURE ACTION

This DTC will be logged, the SERVICE SOON telltale will be turned On for 20 seconds, windshield clearing functions will be disabled, front defog, front de-ice LEDs are turned Off.

RELATED DTCS

None

TELLTALE ILLUMINATED:

SERVICE SOON for 20 seconds.

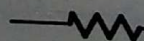
OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

Check the tightness of the female terminal grip with a spare male terminal.

If the problem is intermittent wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.



DTC 28 HEATED WINDSHIELD FAULT

- Vehicle in Run mode.
- IMPORTANT:** Charge coupler must not be inserted in charge receptacle.
- Connect Scan tool.
 - Read and record current and history HTCM DTCs.

Clear HTCM DTCs, then cycle vehicle Off and back On. Did DTC reset?

No

Condition is intermittent.
Refer to Diagnostic Aids.

Yes

Carefully inspect windshield. Is it cracked?

Yes

Replace windshield, verify DTC does not reset.

No

CAUTION: REFER TO "HIGH VOLTAGE DISABLE" IN THIS MANUAL AND DISABLE HIGH VOLTAGE. DISCONNECT APM 6 WAY CONNECTOR. DO THE RESISTANCES ACROSS PINS A, C AND E MATCH THE TABLE BELOW?

No

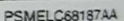
Yes

Replace APM.

RESISTANCE READINGS AT 25°C

A to C	2.7 - 3.1 ohms
A to E	4.1 - 4.8 ohms
C to E	6.4 - 7.4 ohms
A to Ground	Open





Because the accessory power module (APM) does not communicate on the serial data line, it does not store diagnostic trouble DTCs. The HPVS/thermal control module (HTCM) serves as an interface to the APM by storing several APM related diagnostic trouble DTCs and providing status information over serial data. APM status is communicated to the HTCM via six discrete digital interface wires. The APM indicates status and fault conditions by driving these lines high or low. The APM toggles 47V/CMC status line 2 high and low once every second to allow 47 volt and CMC fault detection at the same time. If the CMC detects an over current or over temperature failure, this fault will be reported.

- Open circuit on any of the three compressor motor phases. Short between any of the three compressor motor phases and ground.
- Motor phase to interlock short.
- Short between any of the three compressor motor phases and another phase.
- Seized compressor.
- Restriction in A/C system.
- Auxiliary power module (IGBT failure).

Anytime the HTCMM is awake and heat pump is running. If the CMC detects an overcurrent or IGBT overtemp condition, the HTCMM will be informed (via the discrete digital interface lines). The HTCMM will attempt to reset the CMC three times. If the CMC resumes operation, this fault will be set. The third failure will result in an HTCMM 030 being set.

If the problem is intermittent wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

DTC 29 COMPRESSOR MOTOR CONTROL (CMC) IGBT FAULT #1

- Vehicle in Run mode.
- IMPORTANT:** Charge coupler must not be inserted in charge receptacle.
- Connect Scan tool.
 - Read and record current and history HTCM DTCs.

Is HTCM 25 set?

Yes → Diagnose HTCM DTC 25 first.

No

Clear HTCM DTCs, then cycle vehicle Off and back On. Did DTC reset?

No → Condition is intermittent. Refer to Diagnostic Aids.

Yes

CAUTION: REFER TO "HIGH VOLTAGE DISABLE" IN THIS MANUAL AND DISABLE HIGH VOLTAGE. VEHICLE OFF. CONNECT POWER STEERING AND A/C COMPRESSOR ELECTRICAL TESTER TO COMPRESSOR PIGTAIL. SET DVM TO OHMS AND CONNECT DVM TO TESTER.

Megger CM. Is resistance less than 5.0 Mg?

Yes → Replace compressor.

No

Is the resistance across each winding between 0.8 and 2.0 ohms?

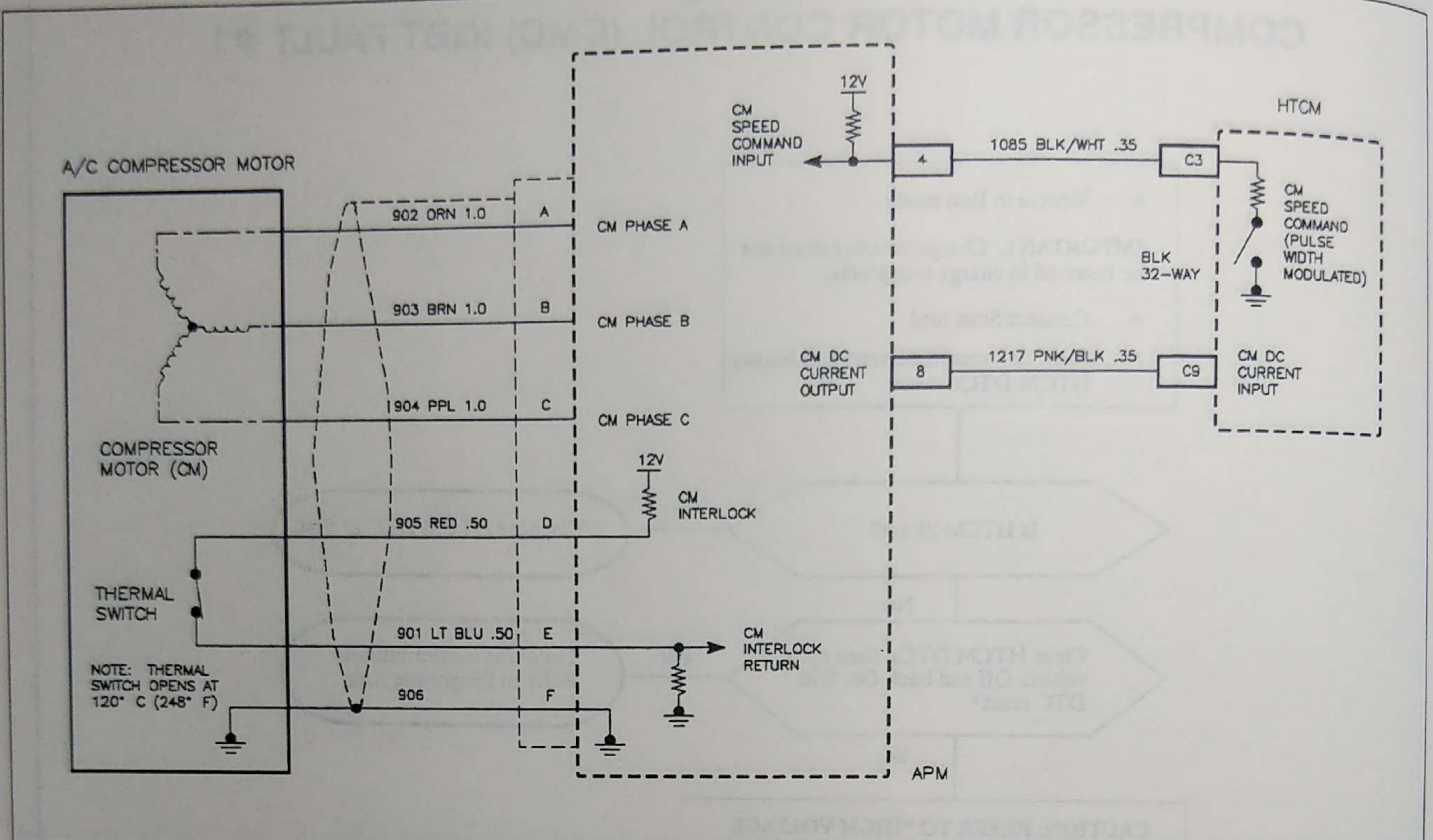
No → Replace compressor.

Yes

Replace APM.

NOTICE: Perform A/C system performance test in this manual.

DTC 30 – COMPRESSOR MOTOR CONTROL (CMC) OVERCURRENT FAULT #2



PSMELC68187AA

COMPRESSOR MOTOR CONTROL (CMC) OVERCURRENT FAULT #2

Because the accessory power module (APM) does not communicate on the serial data line, it does not store diagnostic trouble DTCs. The HPVS/thermal control module (HTCM) serves as an interface to the APM by storing several APM related diagnostic trouble DTCs and providing status information over serial data. APM status is communicated to the HTCM via six discrete digital interface wires. The APM indicates status and fault conditions by driving these lines high or low. The APM toggles 47V/CMC status line two high and low once every second to allow 47 volt and CMC fault detection at the same time. If the CMC detects an over current or over temperature failure, this fault will be reported.

DTC PARAMETERS

DTC 30 will set if:

- Open circuit on any of the three compressor motor phases.
- Short between any of the three compressor motor phases and ground.
- Short between any of the three compressor motor phases and another phase.
- Auxiliary power module (APM) fault.

DTC 30 will set when:

Anytime the HTCM is awake and heat pump is running. If the CMC detects an overcurrent or an APM isolated gate bi-polar transistor (IGBT) overtemp condition, the HTCM will be informed (via the discrete digital interface lines. The HTCM will attempt to reset the CMC three times. If the CMC resumes normal operation, an HTCM DTC 29 will be set. The third failure will result in an HTCM DTC 30 being set.

FAILURE ACTION

This DTC will be logged, and the heat pump will be disabled until power is cycled Off and On.

RELATED DTCS

HTCM 29.

TELLTALE ILLUMINATED:

None

OTHER CONTROLLER INTERFACES

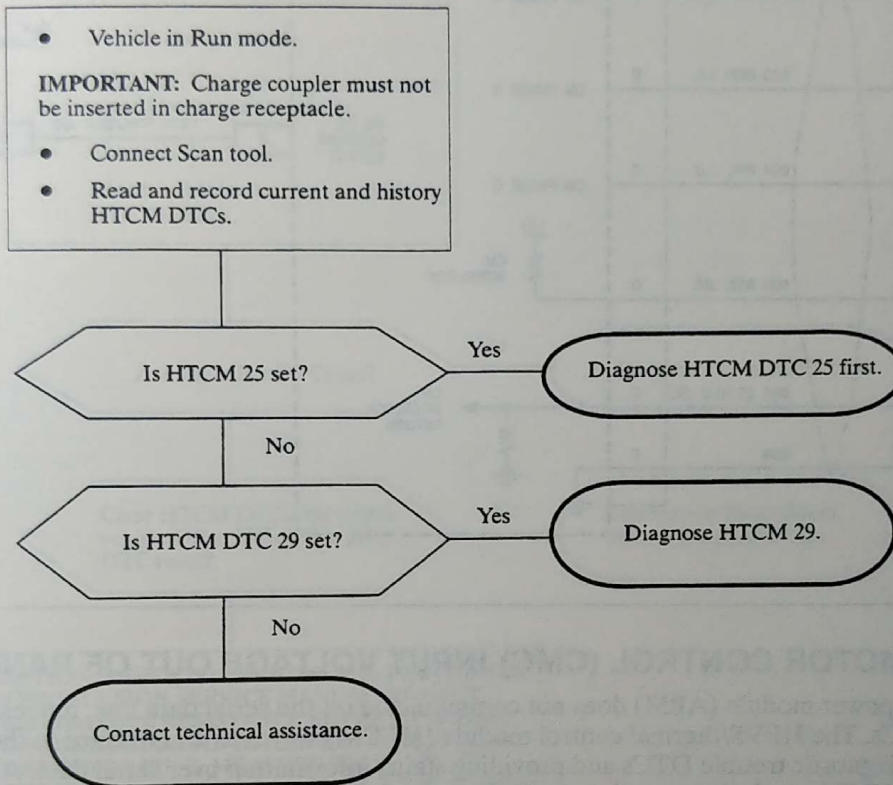
None

DIAGNOSTIC AIDS

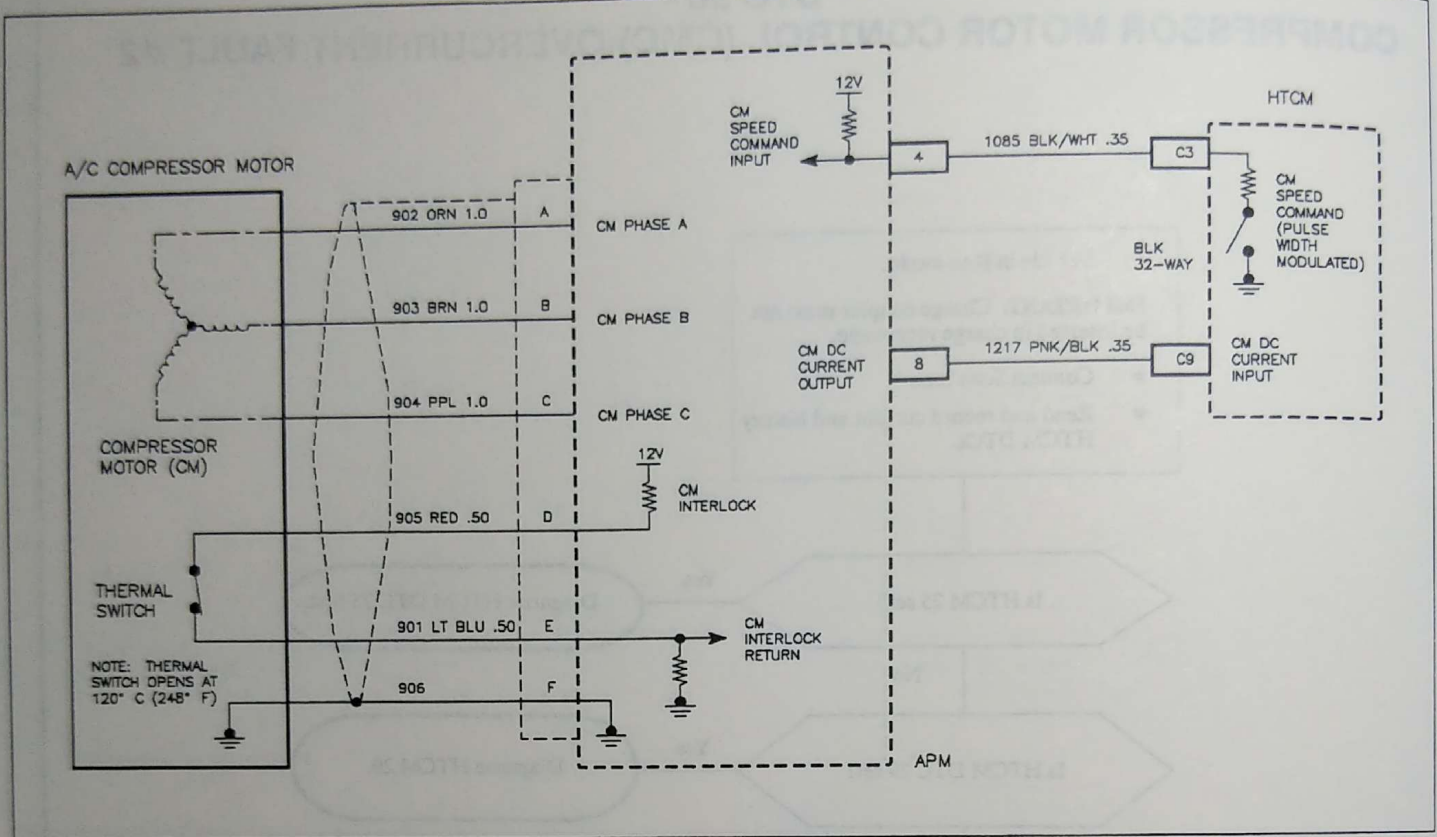
Check the tightness of the female terminal grip with a spare male terminal.

If the problem is intermittent wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

DTC 30 COMPRESSOR MOTOR CONTROL (CMC) OVERCURRENT FAULT #2



DTC 31 – COMPRESSOR MOTOR CONTROL (CMC) INPUT VOLTAGE OUT OF RANGE



PSMELC68187AA

COMPRESSOR MOTOR CONTROL (CMC) INPUT VOLTAGE OUT OF RANGE

Because the accessory power module (APM) does not communicate on the serial data line, it does not store diagnostic trouble DTCs. The HPVS/thermal control module (HTCM) serves as an interface to the APM by storing several APM related diagnostic trouble DTCs and providing status information over serial data. APM status is communicated to the HTCM via six discrete digital interface wires. The APM indicates status and fault conditions by driving these lines high or low. The APM toggles 47V/CMC status line 2 high and low once every second to allow 47 volt and CMC fault detection at the same time. If the CMC detects the input voltage out of range, this fault will be reported.

DTC PARAMETERS

DTC 31 will set if:

- Battery pack low state of charge.
- Battery pack voltage too high (this could occur during preconditioning or regen).

DTC 31 will set when:

Anytime the HTCM is awake and heat pump is running. If the CMC detects input voltage above 430 volts or below 215 volts, this fault will set. This fault should never be set without a related BPM DTC being set.

FAILURE ACTION

This DTC will be logged, the SERVICE SOON telltale will be turned on, and the and the heat pump will be disabled.

RELATED DTCs

BPM 221, 222

TELLTALE ILLUMINATED:

SERVICE SOON

OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

Check the tightness of the female terminal grip with a spare male terminal.

If the problem is intermittent wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

DTC 31 COMPRESSOR MOTOR CONTROL (CMC) INPUT VOLTAGE OUT OF RANGE

- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record current and history HTCM DTCs.

Are any other DTCs set?

Yes

Diagnose other DTCs first.

No

Clear HTCM DTCs, then cycle vehicle Off and back On. Did DTC reset?

No

Condition is intermittent refer to Diagnostic aids.

Yes

CAUTION: REFER TO PEB REMOVAL PROCEDURE IN PROPULSION SERVICE MANUAL. REMOVE PEB. MEASURE RESISTANCE BETWEEN APM TO PIM CONNECTOR PIN A2 AND PIM TO BATTERY CONNECTOR PIN B. MEASURE RESISTANCE BETWEEN APM TO PIM CONNECTOR PIN A1 AND PIM TO BATTERY CONNECTOR PIN E.

Are both resistance readings below 1.0 ohms?

No

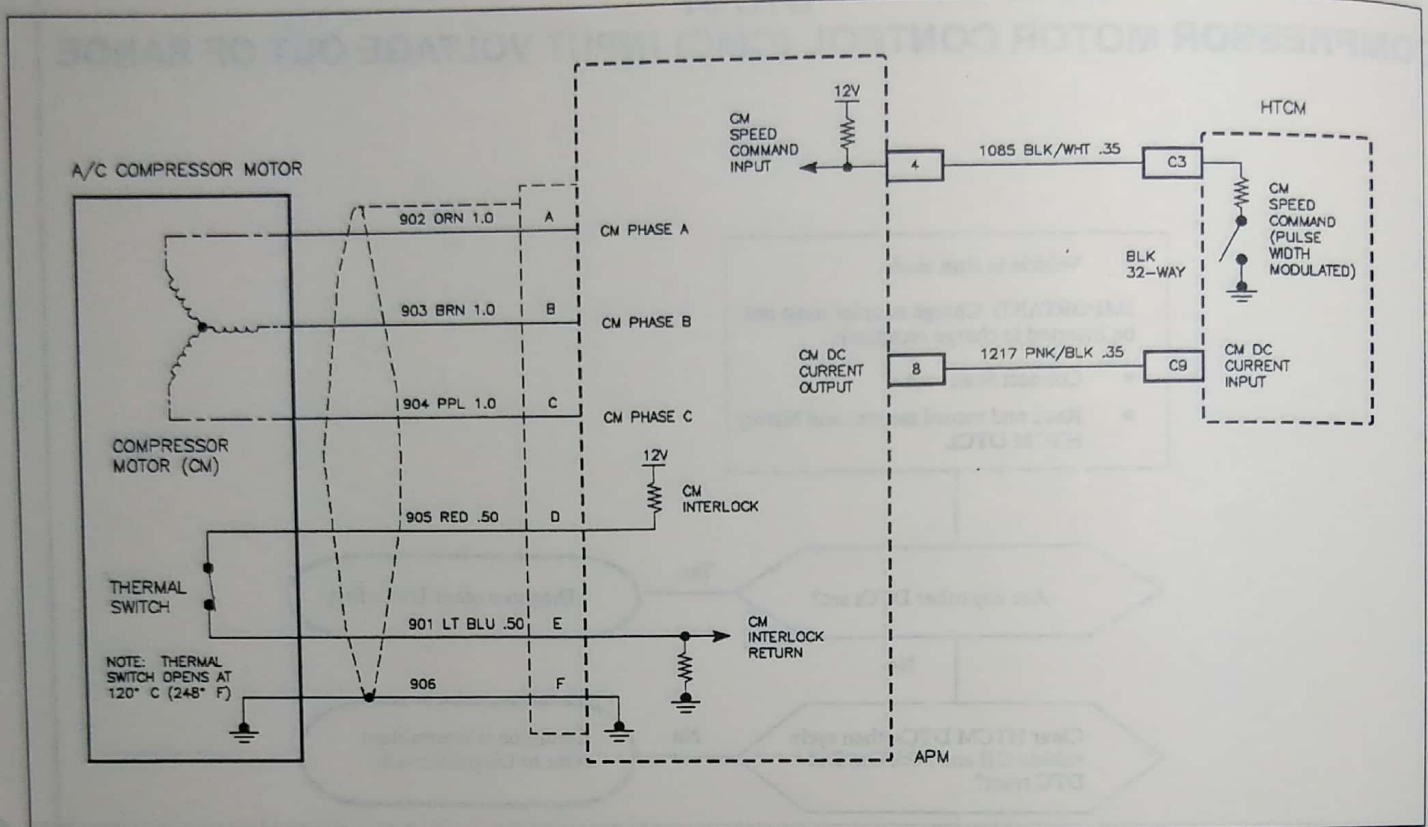
Replace PIM.

Yes

Replace APM.



DTC 32 – COMPRESSOR MOTOR CONTROL (CMC) OVERTEMP OR INTERLOCK FAULT



PSMELC68187AA

COMPRESSOR MOTOR CONTROL (CMC) OVERTEMP OR INTERLOCK FAULT

Because the accessory power module (APM) does not communicate on the serial data line, it does not store diagnostic trouble DTCs. The HPVS/thermal control module (HTCM) serves as an interface to the APM by storing several APM related diagnostic trouble DTCs and providing status information over serial data. APM status is communicated to the HTCM via six discrete digital interface wires. The APM indicates status and fault conditions by driving these lines high or low. The CMC includes an interlock circuit and an over-temperature switch. If the compressor temperature exceeds TBD, the over-temperature switch will open. If this occurs, or if any portion of the interlock circuit opens, the accessory power module (APM) will report that the interlock is open, and the compressor will be shut down.

DTC PARAMETERS

DTC 32 will set if:

- Open compressor circuit.
- Compressor over-temperature.

CMC circuitry problem inadequate output voltage (less than 12 volts) to the interlock loop.

DTC 32 will set when:

Anytime the HTCM is awake and heat pump is running. If the CMC detects an open interlock circuit, this fault will set.

FAILURE ACTION

This DTC will be logged, the SERVICE SOON telltale will be turned On, and the and the heat pump will be disabled.

RELATED DTCS

None

TELLTALE ILLUMINATED:

None

OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

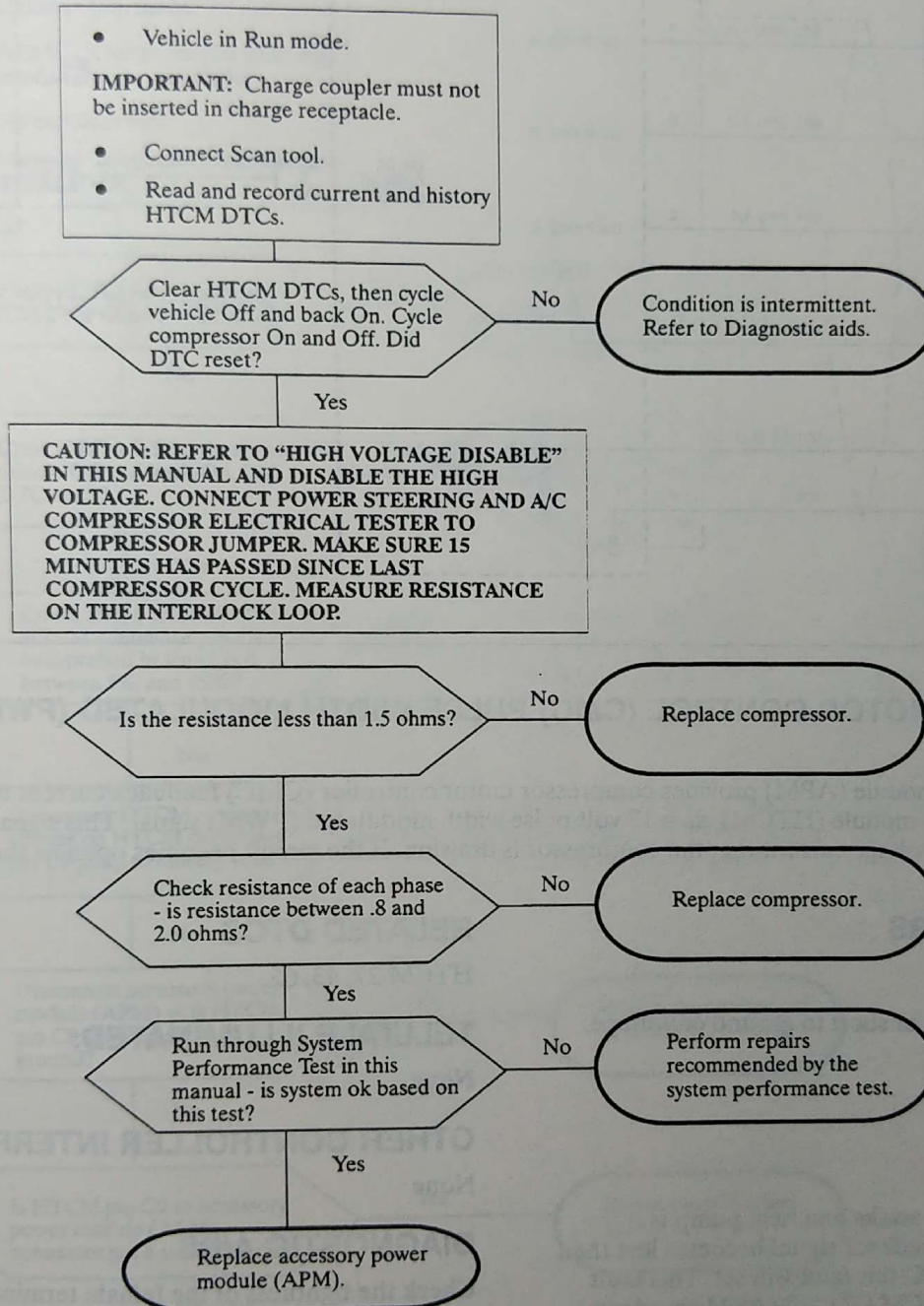
Check the tightness of the female terminal grip with a spare male terminal.

If the problem is intermittent wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

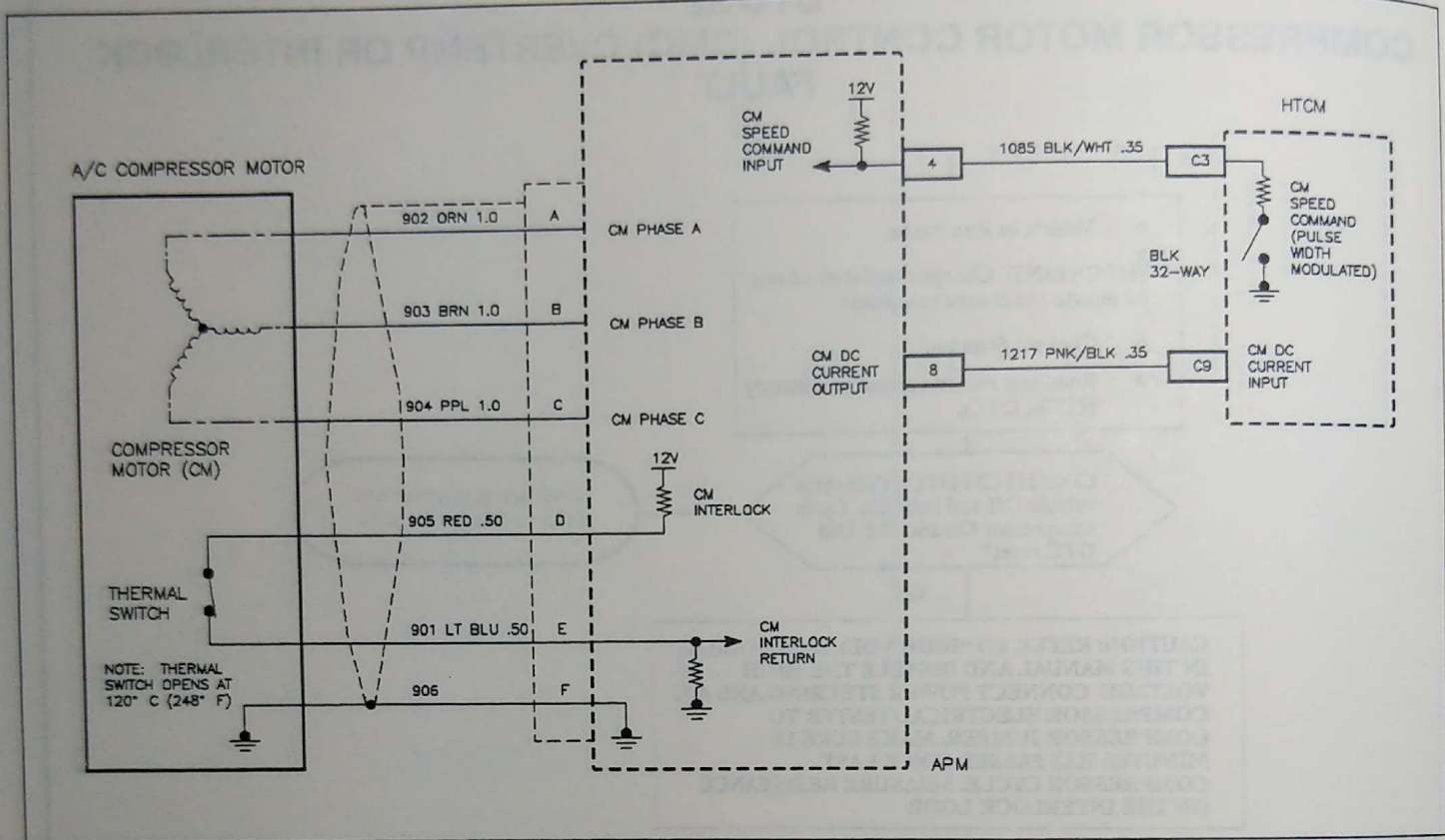
Try running compressor for some time to duplicate DTC.

DTC 32

DTC 32 COMPRESSOR MOTOR CONTROL (CMC) OVERTEMP OR INTERLOCK FAULT



DTC 33 – COMPRESSOR MOTOR CONTROL (CMC) PULSE WIDTH MODULATED (PWM) SIGNAL OUT OF RANGE



PSMELC68187AA

COMPRESSOR MOTOR CONTROL (CMC) PULSE WIDTH MODULATED (PWM) SIGNAL OUT OF RANGE

The accessory power module (APM) provides compressor motor controller (CMC) feedback current to the HPVS/thermal control module (HTCM) via a 12 volt pulse width modulated (PWM) signal. This signal represents the amperage of high voltage current that the compressor is drawing. If the circuit becomes open or shorted, this fault will be reported.

DTC PARAMETERS

DTC 33 will set if:

- PWM circuit open or short to ground or voltage.
- APM failure.
- HTCM failure.

DTC 33 will set when:

Anytime the HTCM is awake and heat pump is running. If the CMC feedback signal becomes less than 5% or greater than 95%, this fault will set. This fault will not be set if an HTCM DTC 27 (APM shutdown) or 43 (automatic disconnect open) is active.

FAILURE ACTION

This DTC will be logged, and the heat pump will be disabled.

RELATED DTCS

HTCM 27, 43, 65.

TELLTALE ILLUMINATED:

None

OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

Check the tightness of the female terminal grip with a spare male terminal.

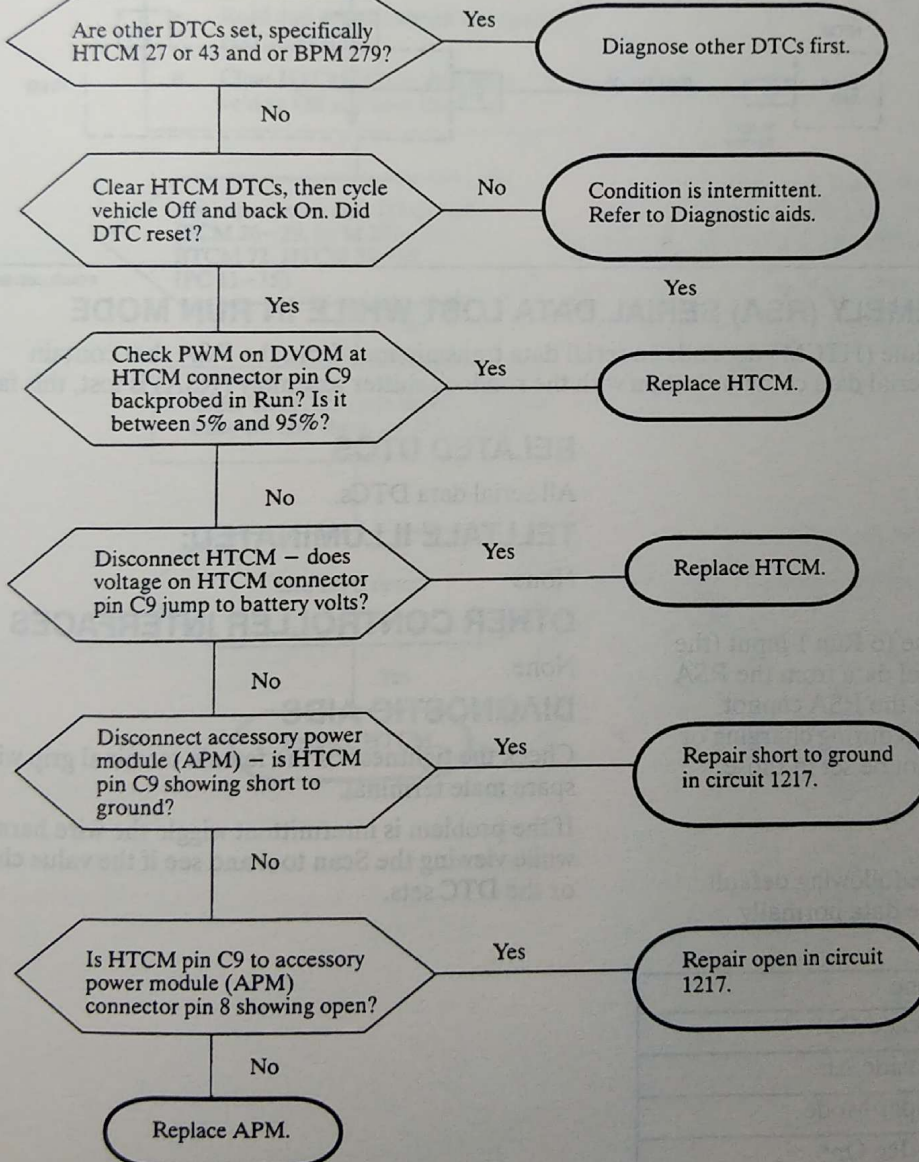
If the problem is intermittent wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

DTC 33 COMPRESSOR MOTOR CONTROL (CMC) PULSE WIDTH MODULATED (PWM) SIGNAL OUT OF RANGE

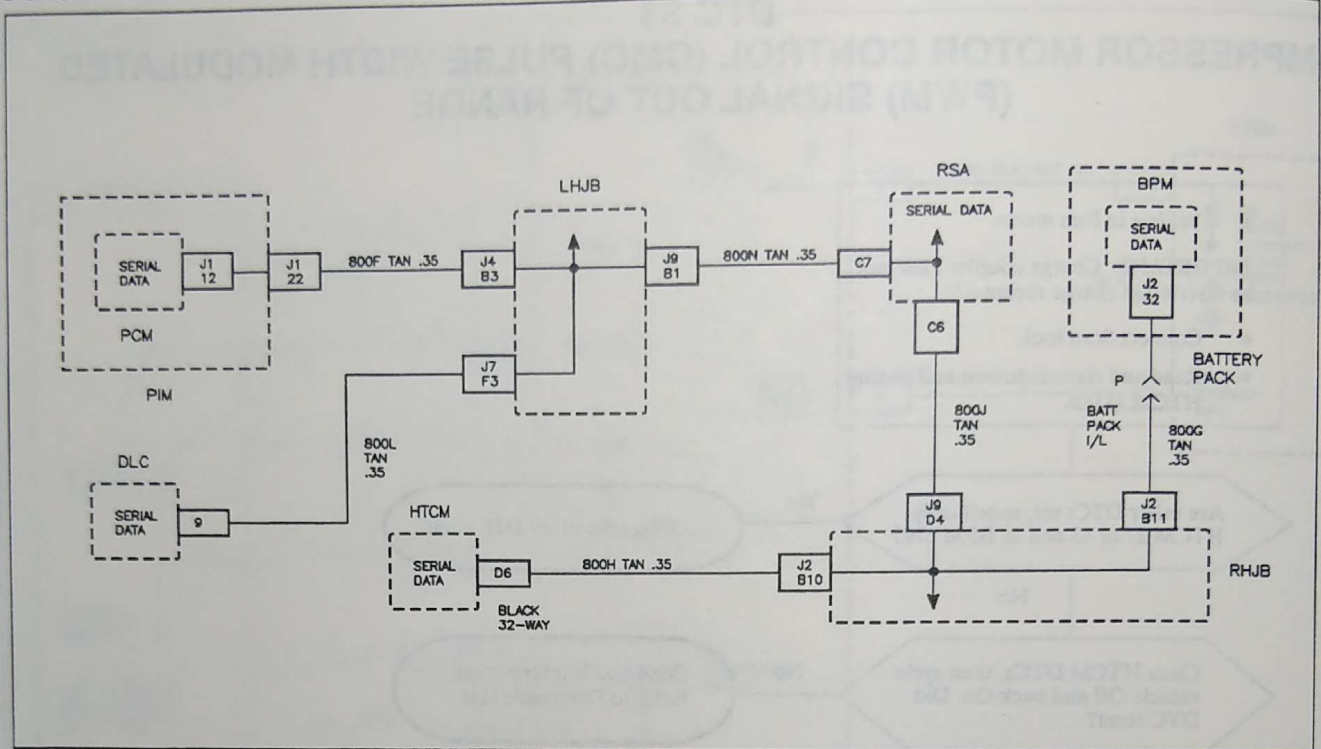
- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record current and history HTCM DTCs.



DTC 34 – RUN/LOCK SHIFT ASSEMBLY (RSA) SERIAL DATA LOST WHILE IN RUN MODE



PSMELC68188AA

RUN/LOCK SHIFT ASSEMBLY (RSA) SERIAL DATA LOST WHILE IN RUN MODE

The HPVS/thermal control module (HTCM) depends on serial data transmissions from the RSA that contain climate control information. If serial data communication with the run/lock shifter assembly (RSA) is lost, this fault will be set.

DTC PARAMETERS

DTC 34 will set if:

- Serial data circuit open.
- Failed RSA.

DTC 34 will set when:

Anytime the HTCM is awake due to Run 1 input (the vehicle is in Run mode) and serial data from the RSA is lost, this fault will set. Because the RSA cannot control the climate control system during charging or preconditioning, this DTC will not be set in those conditions.

FAILURE ACTION

This DTC will be logged, and the following default values will be used in place of the data normally received from the RSA.

Preconditioning Request	None
Time Set Enable/Display	Locked Out
Cabin Air Source	Outside Air
Mode Door Position	Upper Mode
Front Glass Request	De-Ice On*
Back Glass Defogger	Off
Heat Pump	Vent
Cabin Blower	Lowest Speed

* Depending on ambient temperature, the windshield may become hot.

RELATED DTCS

All serial data DTCs.

TELLTALE ILLUMINATED:

None

OTHER CONTROLLER INTERFACES

None

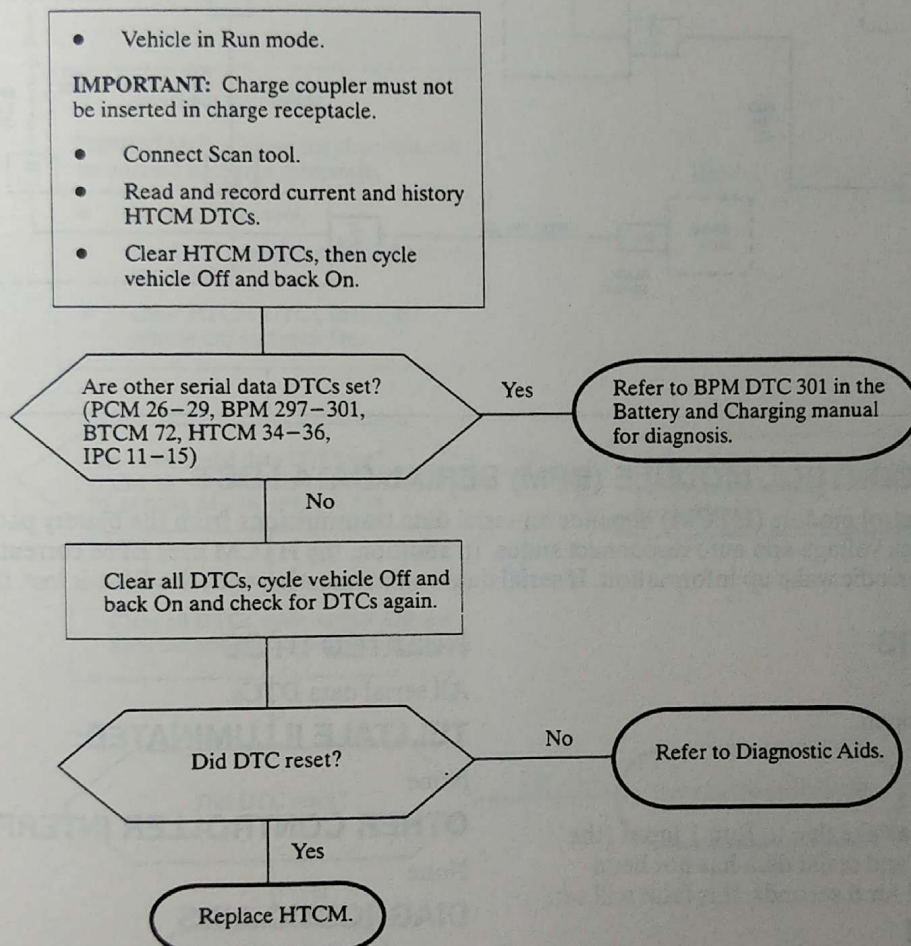
DIAGNOSTIC AIDS

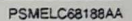
Check the tightness of the female terminal grip with a spare male terminal.

If the problem is intermittent wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

DTC 34

RUN/LOCK SHIFT ASSEMBLY (RSA) SERIAL DATA LOST WHILE IN RUN MODE





The HPVS/thermal control module (HTCM) depends on serial data transmissions from the battery pack module (BPM) that contain pack voltage and auto disconnect status. In addition, the HTCM uses BPM current, charge port cooling request, and periodic wake up information. If serial data communication with the RSA is lost, this fault will be set.

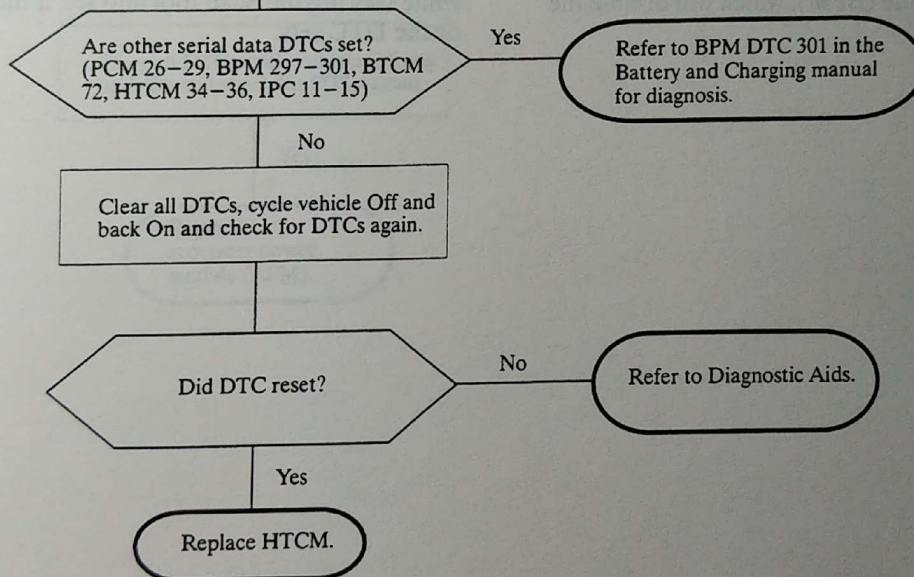
If the problem is intermittent wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

DTC 36 BATTERY PACK CONTROL MODULE (BPM) SERIAL DATA LOST

- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record current and history HTCM DTCs.
- Clear HTCM DTCs, then cycle vehicle Off and back On.



DTC 37 – ACCESSORY POWER MODULE (APM) 12 VOLT OUT OF RANGE MAJOR

Because the accessory power module (APM) does not communicate on the serial data line, it does not store diagnostic trouble DTCs. The HPVS/thermal control module (HTCM) serves as an interface to the APM by storing several APM related diagnostic trouble DTCs and providing status information over serial data. APM status is communicated to the HTCM via six discrete digital interface wires. The APM indicates status and fault conditions by driving these lines high or low. If the APM 12 volt regulated output goes extremely out of range, this DTC will be set.

DTC PARAMETERS

DTC 37 will set if:

APM fault.

DTC 37 will set when:

Anytime the HTCM is awake. This fault exists if the 12 volt regulated output goes above 16.0 volts or below 10.5 volts with current less than 100 amps..

FAILURE ACTION

This DTC will be logged, the SERVICE SOON telltale will be turned On, and the cabin blower and rear defogger will be disabled. In addition, the failure status will be communicated (via normal mode serial data) to the battery pack module (BPM), which will disable the battery pack fan.

RELATED DTCS

BPM 310, 311, PCM 59, 60, 104.

TELLTALE ILLUMINATED:

None

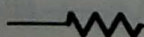
OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

Check the tightness of the female terminal grip with a spare male terminal.

If the problem is intermittent wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

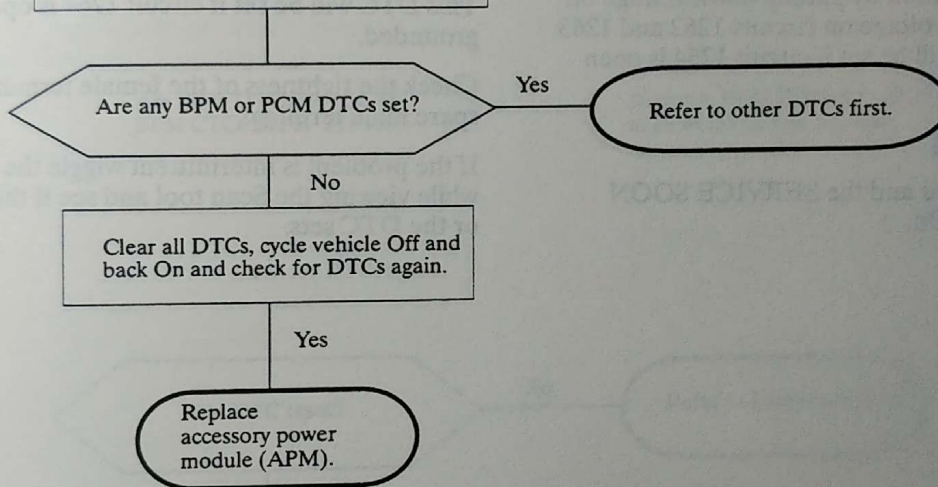


DTC 37 ACCESSORY POWER MODULE (APM) 12 VOLT OUT OF RANGE MAJOR

- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record current and history HTCM DTCs.



DTC 38 – ACCESSORY POWER MODULE (APM) LOW AUXILIARY BATTERY

Because the accessory power module does not communicate on the serial data line, it does not store diagnostic trouble DTCs. The HPVS/thermal control module (HTCM) serves as an interface to the APM by storing several APM related diagnostic trouble DTCs and providing status information over serial data. APM status is communicated to the HTCM via six discrete digital interface wires. The APM indicates status and fault conditions by driving these lines high or low. If the APM voltage is determined to be below 10.5 volts, this DTC will be set.

DTC PARAMETERS

DTC 38 will set if:

- Circuit 1264 open or grounded.
- APM fault.
- Auxiliary battery failure.

DTC 38 will set when:

Anytime the HTCM is awake. This fault exists if the 12 volt regulated output goes below 10.5 volts. The APM will indicate this fault by pulling down voltage on circuit 1264, while the voltage on circuits 1262 and 1263 stays high. This DTC will be set if circuit 1264 is open or grounded.

FAILURE ACTION

This DTC will be logged and the SERVICE SOON telltale will be turned On.

RELATED DTCS

HTCM 65, PCM 59, PCM 104, BPM 282, BPM 311

TELLTALE ILLUMINATED:

SERVICE SOON

OTHER CONTROLLER INTERFACES

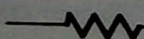
None

DIAGNOSTIC AIDS

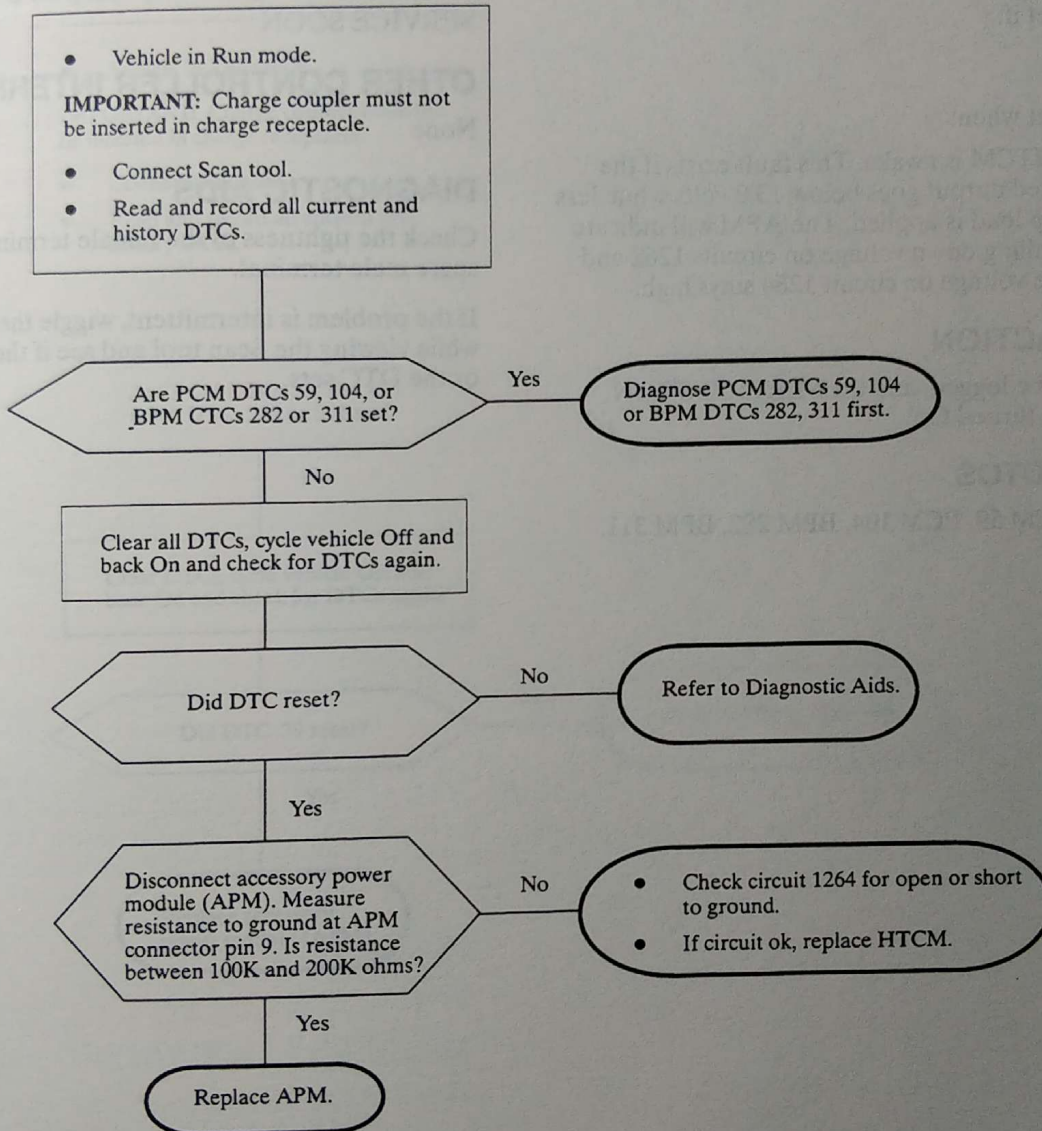
This DTC will be set if circuit 1264 is open or grounded.

Check the tightness of the female terminal grip with a spare male terminal.

If the problem is intermittent wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.



DTC 38 ACCESSORY POWER MODULE (APM) 12 VOLT OUT OF RANGE MAJOR



DTC 39 – ACCESSORY POWER MODULE (APM) 12 VOLT OUT OF RANGE MINOR

Because the accessory power module (APM) does not communicate on the serial data line, it does not store DTCs. The HPVS/thermal control module (HTCM) serves as an interface to the APM by storing several APM related DTCs and providing status information over serial data. APM status is communicated to the HTCM via six discrete digital interface wires. The APM indicates status and fault conditions by driving these lines high or low. If the APM 12 volt regulated output goes out of range, this DTC will be set.

DTC PARAMETERS

DTC 39 will set if:

APM fault.

DTC 39 will set when:

Anytime the HTCM is awake. This fault exists if the 12 volt regulated output goes below 13.0 volts while less than a 100 amp load is applied. The APM will indicate this fault by pulling down voltage on circuits 1262 and 1263, while the voltage on circuit 1264 stays high.

FAILURE ACTION

This DTC will be logged, and the SERVICE SOON telltale will be turned On.

RELATED DTCS

HTCM 40, PCM 59, PCM 104, BPM 282, BPM 311.

TELLTALE ILLUMINATED:

SERVICE SOON

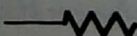
OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

Check the tightness of the female terminal grip with a spare male terminal.

If the problem is intermittent, wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.



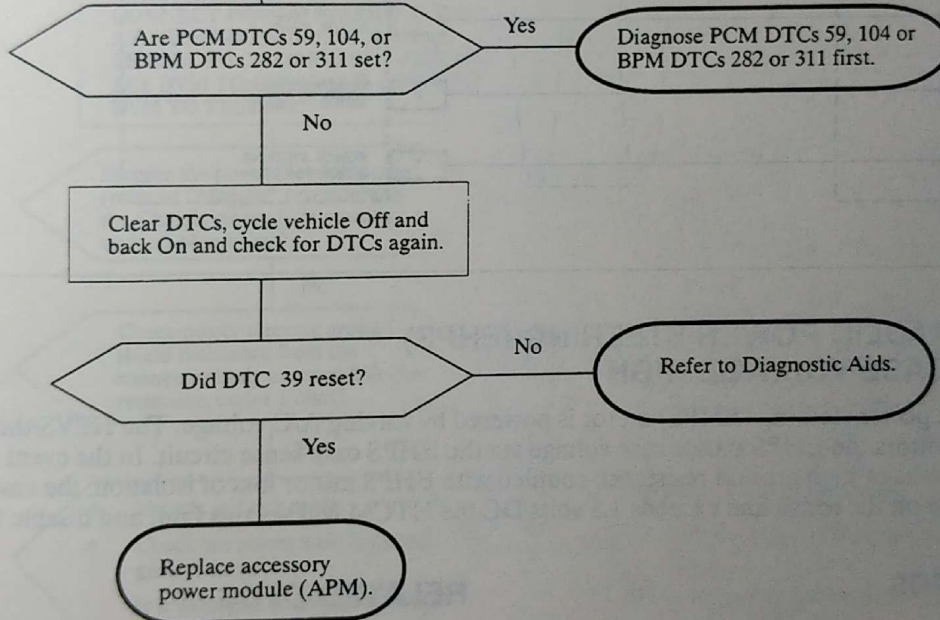
DTC 39 ACCESSORY POWER MODULE (APM) 12 VOLT OUT OF RANGE MINOR

IMPORTANT: Make sure heated windshield is Off before performing this trouble tree.

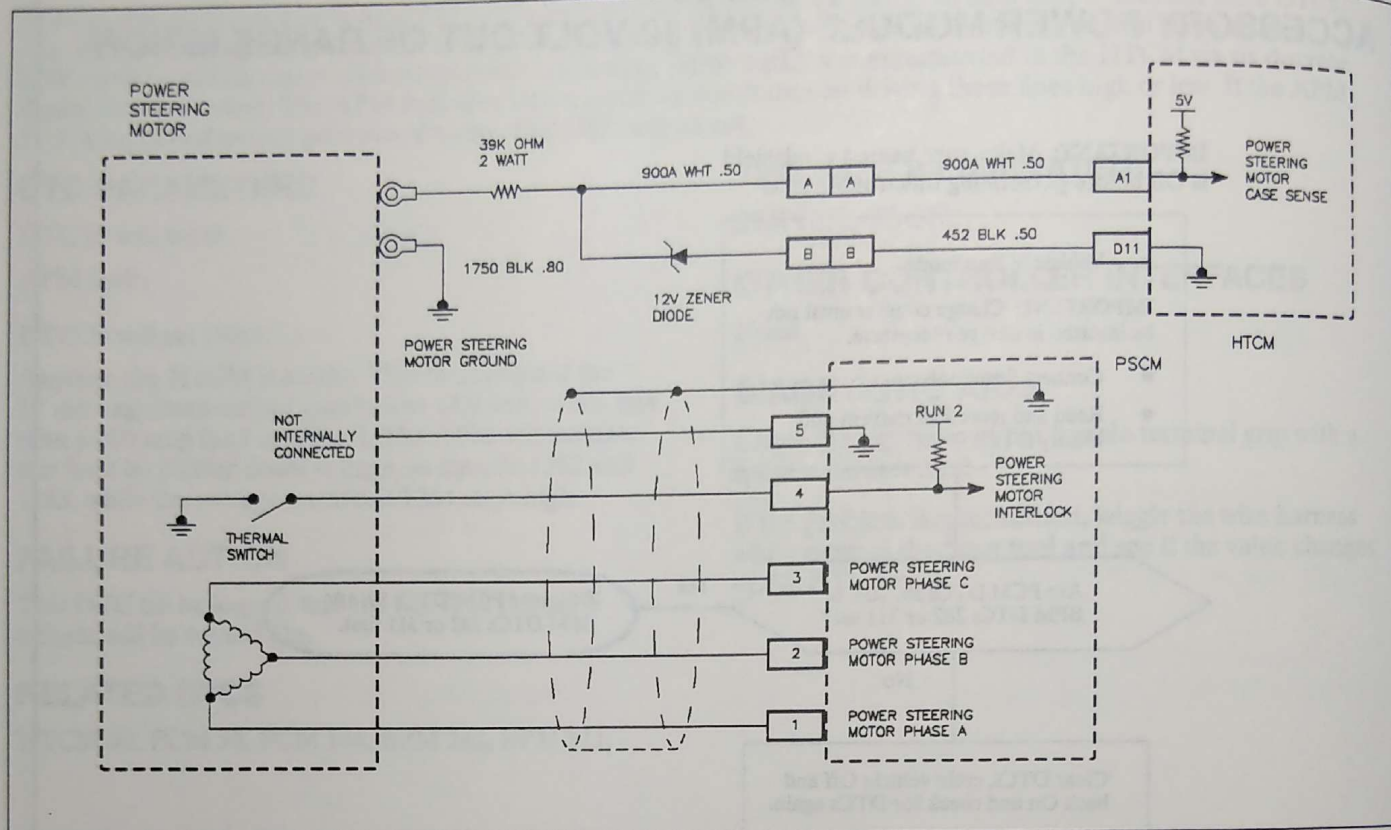
- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record all current and history DTCs.



DTC 40 – ELECTRO-HYDRAULIC POWER STEERING (EHPS) PUMP MOTOR CASE VOLTAGE HIGH



PSMELC68345AB

ELECTRO-HYDRAULIC POWER STEERING (EHPS) PUMP MOTOR CASE VOLTAGE HIGH

The electro-hydraulic power steering (EHPS) motor is powered by varying A/C voltage. The HPV/S/thermal control module (HTCM) monitors the EHPS motor case voltage via the EHPS case sense circuit. In the event of the loss of both EHPS ground paths or high ground resistance coupled with EHPS motor loss of isolation, the case voltage will rise. When the voltage on the sense line exceeds 1.5 volts DC the HTCM will set this fault and disable the compressor.

DTC PARAMETERS

DTC 40 will set if:

- Circuit 900A open.
- Ground sensing harness assembly fault.
- Total loss of EHPS motor ground
- Partial Loss of EHPS motor ground, combined with loss of EHPS motor isolation.
- HTCM fault.

DTC 40 will set when:

Anytime the HTCM is awake. This fault exists if the HTCM detects voltage greater than 1.5 volts DC at the EHPS motor case sense input.

FAILURE ACTION

This DTC will be logged, the EHPS motor may be disabled, and the SERVICE SOON telltale will be turned On.

RELATED DTCS

None

TELLTALE ILLUMINATED:

SERVICE SOON

OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

If the problem is not resolved by using the trouble tree, try spraying the power steering pump ground sensing harness, and connectors with salt water, then step through the trouble tree again.

Check the tightness of the female terminal grip with a spare male terminal.

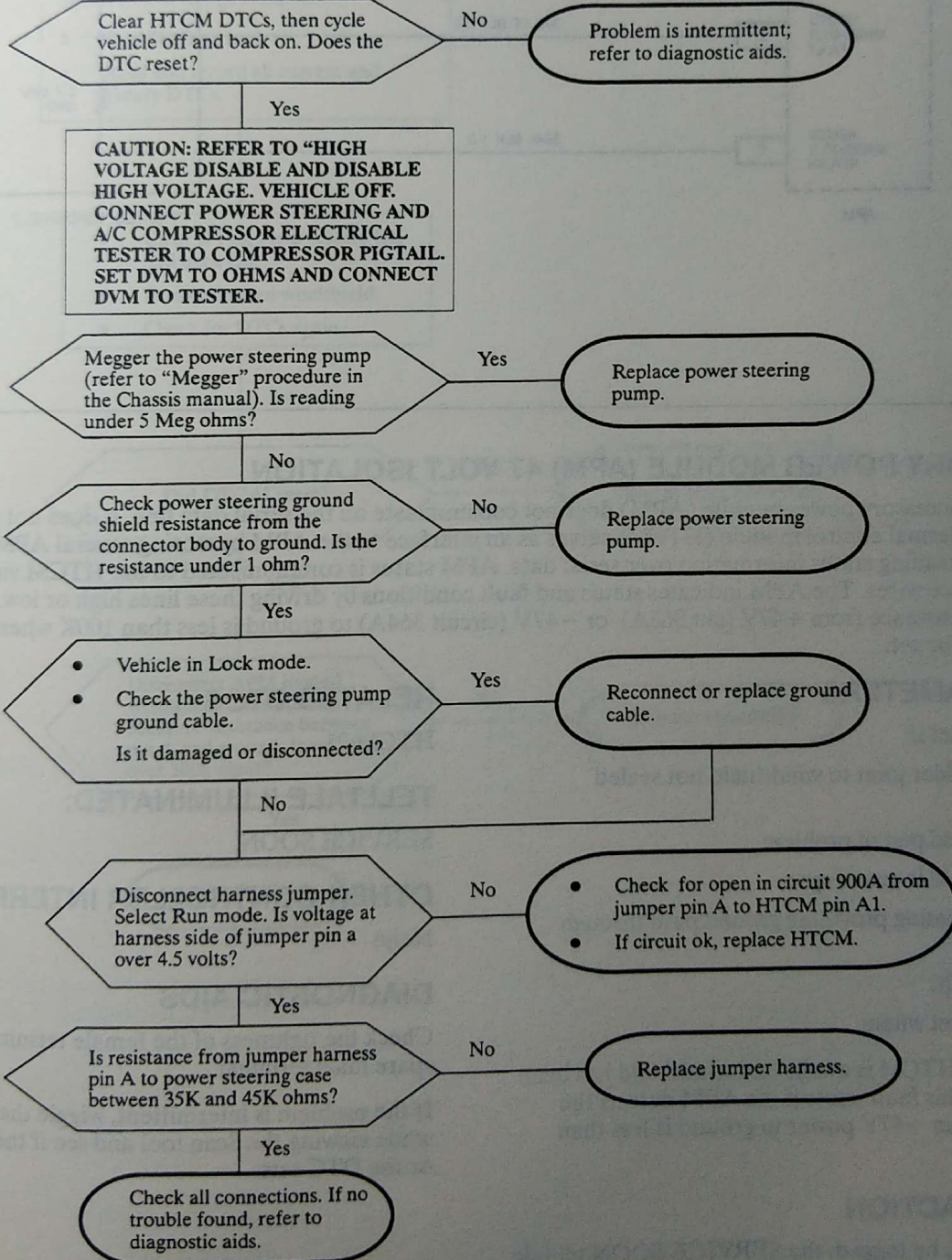
If the problem is intermittent, wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

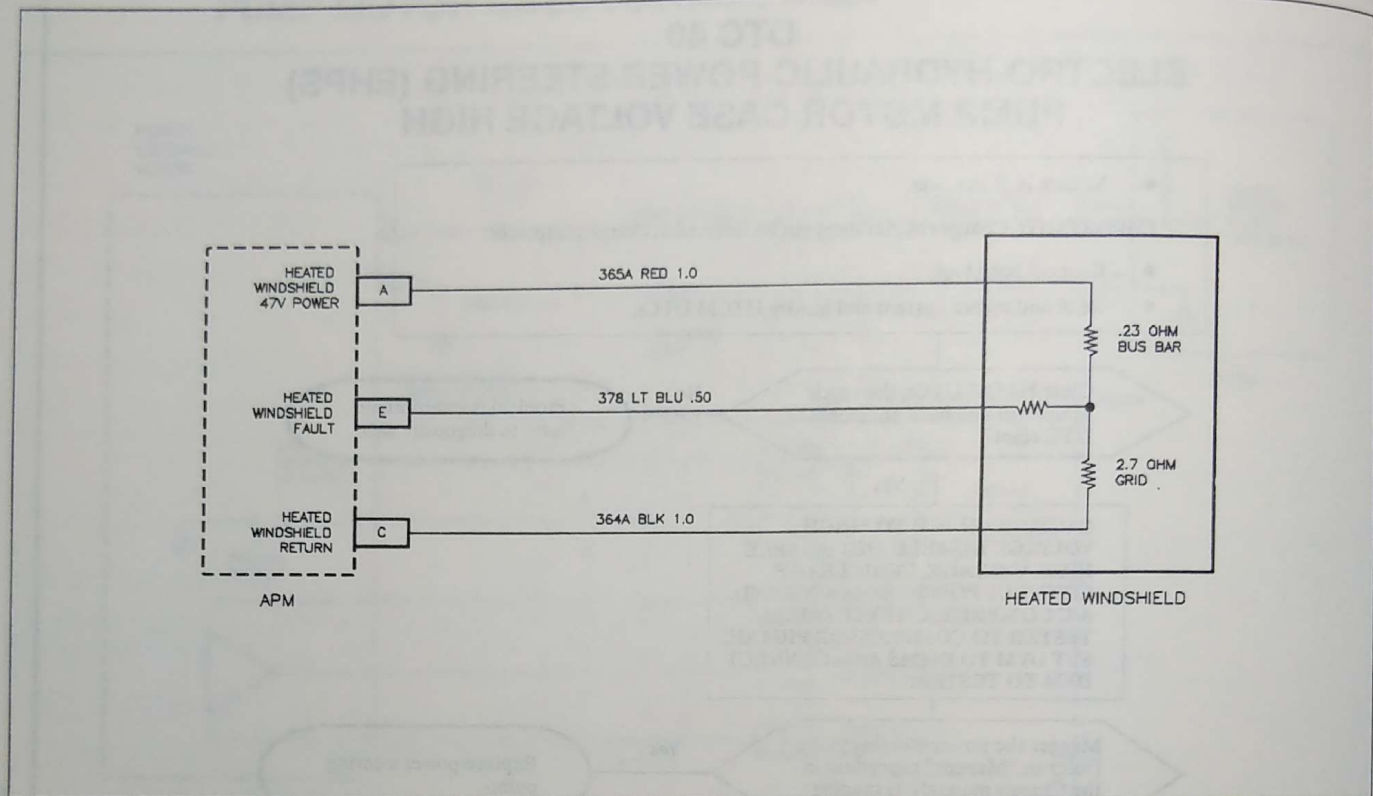
DTC 40 ELECTRO-HYDRAULIC POWER STEERING (EHPS) PUMP MOTOR CASE VOLTAGE HIGH

- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record current and history HTCM DTCs.



DTC 41 – ACCESSORY POWER MODULE (APM) 47 VOLT ISOLATION

PSMELC68344AA

ACCESSORY POWER MODULE (APM) 47 VOLT ISOLATION

Because the accessory power module (APM) does not communicate on the serial data line, it does not store DTCs. The HPVS/thermal control module (HTCM) serves as an interface to the APM by storing several APM related DTCs and providing status information over serial data. APM status is communicated to the HTCM via six discrete digital interface wires. The APM indicates status and fault conditions by driving these lines high or low. If the APM detects the resistance from +47V (ckt 365A) or -47V (circuit 364A) to ground is less than 100K when turned on, this fault will be set.

DTC PARAMETERS

DTC 41 will set if:

- Pigtail solder joint to windshield not sealed properly.
- Windshield pigtail problem.
- Windshield is out of spec.
- Sputtercoating providing ground path through urethane
- APM fault.

DTC 41 will set when:

Anytime the HTCM is awake and windshield has been turned On. This fault exists if the APM detects the resistance from +47V power to ground is less than 100K at 50V.

FAILURE ACTION

This DTC will be logged, the SERVICE SOON telltale will be turned On, and the APM reduces the 47V output to 42V when activated (windshield clearing will take longer).

RELATED DTCS

HTCM 21

TELLTALE ILLUMINATED:

SERVICE SOON.

OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

Check the tightness of the female terminal grip with a spare male terminal.

If the problem is intermittent, wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.



DTC 41 ACCESSORY POWER MODULE (APM) 47 VOLT ISOLATION

- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record all current and history DTCs.

- Clear DTCs, cycle vehicle Off and back On.
- Turn on heated windshield.
- Check for DTCs again.

Did DTC 41 reset?

No

Refer to Diagnostic Aids.

Yes

Disconnect APM heated windshield connectors. Measure resistance between pin A and ground. Is resistance over 300k ohms?

No

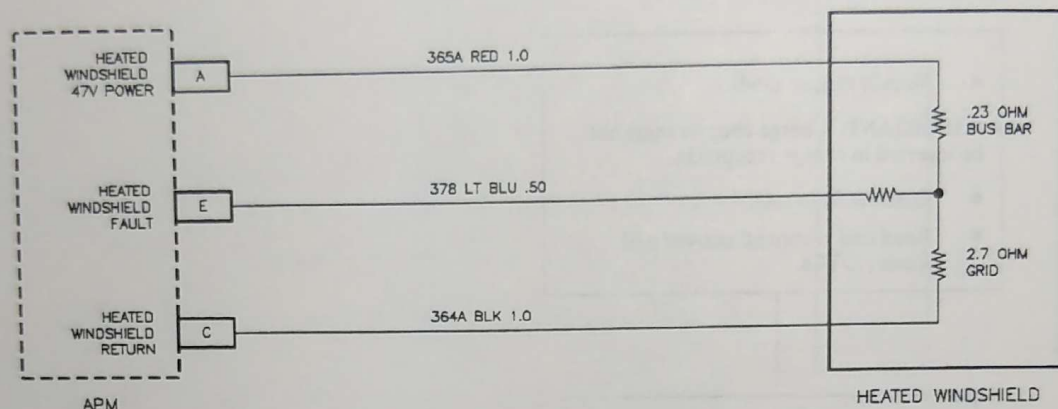
Replace windshield.

Yes

Replace APM.



DTC 42 – ACCESSORY POWER MODULE (APM) 47 VOLT OUT OF RANGE



PSMELC68344AA

ACCESSORY POWER MODULE (APM) 47 VOLT OUT OF RANGE

Because the accessory power module (APM) does not communicate on the serial data line, it does not store DTCs. The HPVS/thermal control module (HTCM) serves as an interface to the APM by storing several APM related DTCs and providing status information over serial data. APM status is communicated to the HTCM via six discrete digital interface wires. The APM indicates status and fault conditions by driving these lines high or low. If the APM 47 volt output goes out of range, this DTC will be set.

DTC PARAMETERS

DTC 42 will set if:

- Windshield resistance low (<2.4 ohms)
- APM fault.

DTC 42 will set when:

Anytime the HTCM is awake. This fault exists if the 47 volt output goes above 63.5 volts or below 37.5 volts.

FAILURE ACTION

This DTC will be logged, and the SERVICE SOON telltale will be turned On.

RELATED DTCS

None

TELLTALE ILLUMINATED:

SERVICE SOON

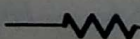
OTHER CONTROLLER INTERFACES

None

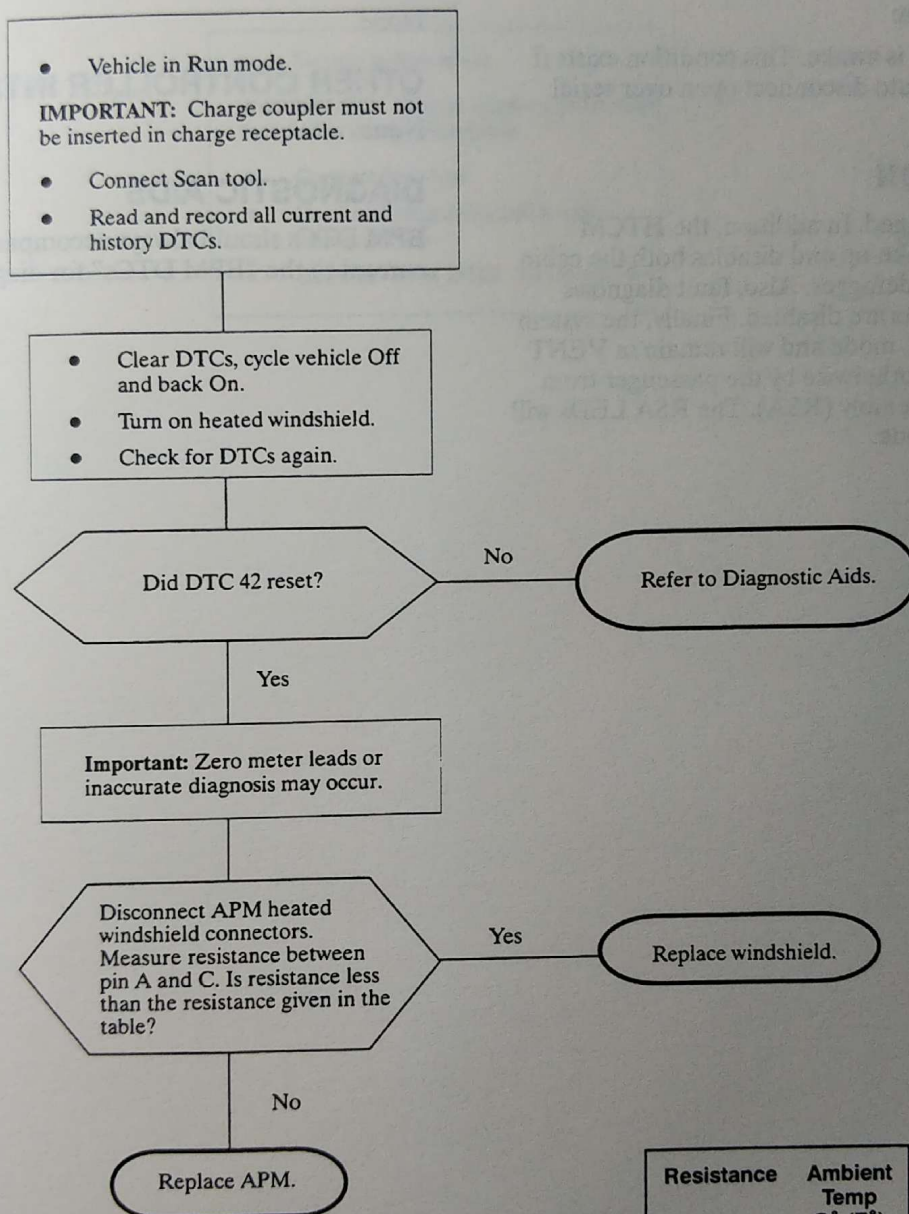
DIAGNOSTIC AIDS

Check the tightness of the female terminal grip with a spare male terminal.

If the problem is intermittent, wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.



DTC 42 ACCESSORY POWER MODULE (APM) 47 VOLT OUT OF RANGE



Resistance	Ambient Temp C° (F°)
2.4	0 (32)
2.7	25 (77)
3.0	50 (122)



DTC 43 – AUTOMATIC DISCONNECT OPEN

The HPVS/thermal control module (HTCM) constantly monitors the serial data line to receive information from and about other controllers. If the BPM indicates (via serial data) that the auto disconnect is open, this DTC will be set.

DTC PARAMETERS

DTC 43 will set if:

The automatic disconnect is open.

DTC 43 will set when:

Anytime the HTCM is awake. This condition exists if the BPM indicates auto disconnect open over serial data.

FAILURE ACTION

This DTC will be logged. In addition, the HTCM de-asserts vehicle wake-up and disables both the cabin blower and the rear defogger. Also, fault diagnosis requiring APM inputs are disabled. Finally, the system will default to VENT mode and will remain in VENT mode until selected otherwise by the passenger from the run/lock shift assembly (RSA). The RSA LEDs will change to VENT mode.

RELATED DTCS

BPM 272 through BPM 280.

TELLTALE ILLUMINATED:

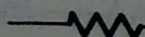
None

OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

BPM DTCs should always accompany this DTC. If it is current to the "BPM DTCs" for diagnosis.



DTC 43 AUTOMATIC DISCONNECT OPEN

- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record all current and history DTCs.
- Refer to "BPM DTCs" for diagnosis.



DTC 44 – PACK VOLTAGE FAULT

The HPVS/thermal control module (HTCM) constantly monitors the serial data line to receive information from and about other controllers. If the BPM indicates (via serial data) that there is a pack voltage fault, this DTC will be set.

DTC PARAMETERS

DTC 44 will set if:

Battery pack voltage faults.

DTC 44 will set when:

Anytime the HTCM is awake. This fault exists if the BPM indicates auto disconnect open over serial data.

FAILURE ACTION

This DTC will be logged. In addition, the heat pump is disabled.

RELATED DTCS

BPM module and pack faults.

TELLTALE ILLUMINATED:

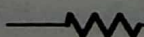
None

OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

BPM DTCs should always accompany this DTC. Refer to the “BPM DTCs” for diagnosis.



DTC 44 PACK VOLTAGE FAULT

- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record all current and history DTCs.
- Refer to "BPM DTCs" in the "Battery and Charging System" service manual for diagnosis.



DTC 45 – HTCM MEMORY FAILURE

Each time the HPVS/thermal control module (HTCM) is powered up an initialization process tests a value in memory against the same value in EEPROM for a match. If the values do not match, this DTC will be set.

DTC PARAMETERS

DTC 45 will set if:

HTCM memory (EEPROM) failure.

DTC 45 will set when:

Each time the HTCM is awakened. Every time the system is powered up, it performs a self test that compares a value in memory against the same value in EEPROM. If these two values do not match, this DTC will be set.

RELATED DTCS

None

TELLTALE ILLUMINATED:

None

OTHER CONTROLLER INTERFACES

None

FAILURE ACTION

This DTC will be logged and the SERVICE SOON telltale will be turned On.

DTC 45 HTCM MEMORY FAILURE

- If DTC 45 is set it is due to an internal HTCM fault.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Replace HTCM.

DTC 46 – ACCESSORY POWER MODULE (APM) OVER TEMPERATURE

Because the accessory power module (APM) does not communicate on the serial data line, it does not store DTCs. The HPVS/thermal control module (HTCM) serves as an interface to the APM by storing several APM related DTCs and providing status information over serial data. APM status is communicated to the HTCM via six discrete digital interface wires. The APM indicates status and fault conditions by driving these lines high or low. If the APM's temperature is excessive, this DTC will be set.

DTC PARAMETERS

DTC 46 will set if:

- APM fault.
- Cooling system failure.

DTC 46 will set when:

Anytime the HTCM is awake. This fault exists if the APM determines that it has exceeded its temperature limit.

FAILURE ACTION

This DTC will be logged and the temperature (TEMP) telltale will be turned On. In addition, both the rear defogger and the cabin blower are disabled. Also, the battery pack module is informed (via serial data) of the APM failure so that it will disable charging and the battery pack fan. Finally, the following over temperature actions are taken:

- Front end fan (FEF) and coolant pump are forced to high speed (14.5V).
- The coolant valve is forced to the radiator position.
- The heat pump is disabled.
- Preconditioning is disabled.
- Regenerative braking is disabled.

RELATED DTCS

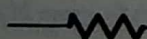
HTCM 47-64 or PCM 34, 36, 37

TELLTALE ILLUMINATED:

Temperature (TEMP)

OTHER CONTROLLER INTERFACES

None



DTC 46 ACCESSORY POWER MODULE (APM) OVER TEMPERATURE

- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record all current and history DTCs.

Are any other HTCM or PCM DTCs set?

Yes

Diagnose PCM DTCs first.

No

- Clear DTCs, cycle vehicle Off and back On.
- Check for DTCs again.

Replace APM.



DTC 47 – COOLANT OVER TEMPERATURE

The temperature sensors are thermistors that change resistance with temperature change. The sensors have higher resistance as they get colder, lower resistance as temperatures increase. The HPVS/thermal control module (HTCM) provides a five volt signal to the temperature sensors, which ground through the right hand junction block. If the coolant temperature monitored by the pump coolant temperature (PCTS) is excessive, this DTC will be set.

DTC PARAMETERS

DTC 47 will set if:

Cooling system failure.

DTC 47 will set when:

Anytime the HTCM is awake. This fault exists if the coolant temperature measured by the PCTS exceeds 74.0°C (165.2°F) in Run mode or 60.0°C (140.0°F) while charging.

FAILURE ACTION

This DTC will be logged and the temperature (TEMP) telltale will be turned On. The following over temperature actions are taken:

- Front end fan (FEF) and coolant pump are forced to high speed.
- (14.5V) APM voltage output (98% duty cycle).
- The coolant valve is forced to the radiator position.
- The heat pump is disabled.
- Charging disable
- Preconditioning is disabled.
- Regenerative braking is disabled.

RELATED DTCS

BPM 296

TELLTALE ILLUMINATED:

Temperature (TEMP)

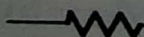
OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

Check the tightness of the female terminal grip with a spare male terminal.

If the problem is intermittent, wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

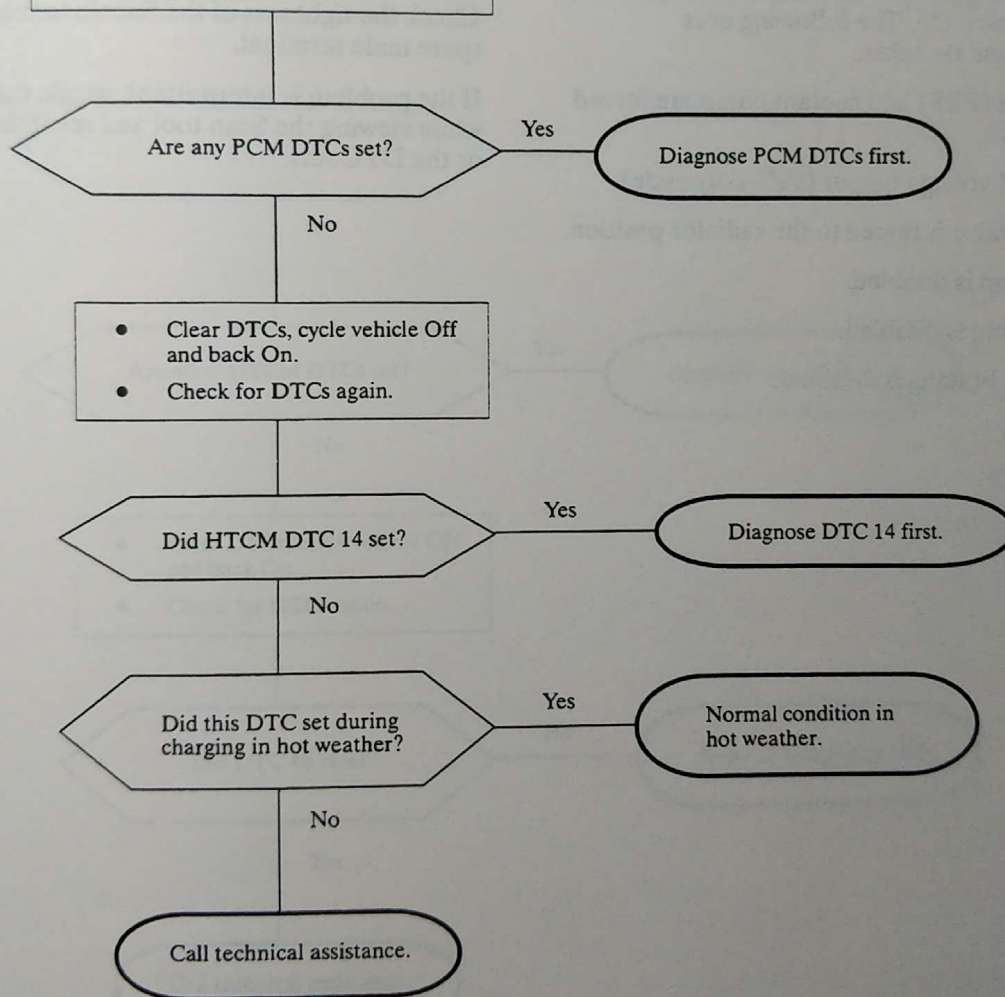


DTC 47 COOLANT OVER TEMPERATURE

- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record all current and history DTCs.



DTC 48 – DRIVE MOTOR OVER TEMPERATURE

The temperature sensors are thermistors that change resistance with temperature change. The sensors have higher resistance as they get colder, lower resistance as temperatures increase. The HPVS/thermal control module (HTCM) provides a five volt signal to the temperature sensors, which ground through the right hand junction block. If the drive motor temperature is excessive, this DTC will be set.

DTC PARAMETERS

DTC 48 will set if:

Cooling system failure.

DTC 48 will set when:

Anytime the HTCM is awake. This fault exists if the drive motor temperature exceeds 93.0°C (199.4°F).

FAILURE ACTION

This DTC will be logged and the temperature (TEMP) telltale will be turned On. The following over temperature actions are taken:

- Front end fan (FEF) and coolant pump are forced to high speed.
- (14.5V) APM voltage output (98% duty cycle)
- The coolant valve is forced to the radiator position.
- The heat pump is disabled.
- Preconditioning is disabled.
- Regenerative braking is disabled.

RELATED DTCS

HTCM 12, 17, PCM 34, 36, 37

TELLTALE ILLUMINATED:

Temperature (TEMP)

OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

Check the tightness of the female terminal grip with a spare male terminal.

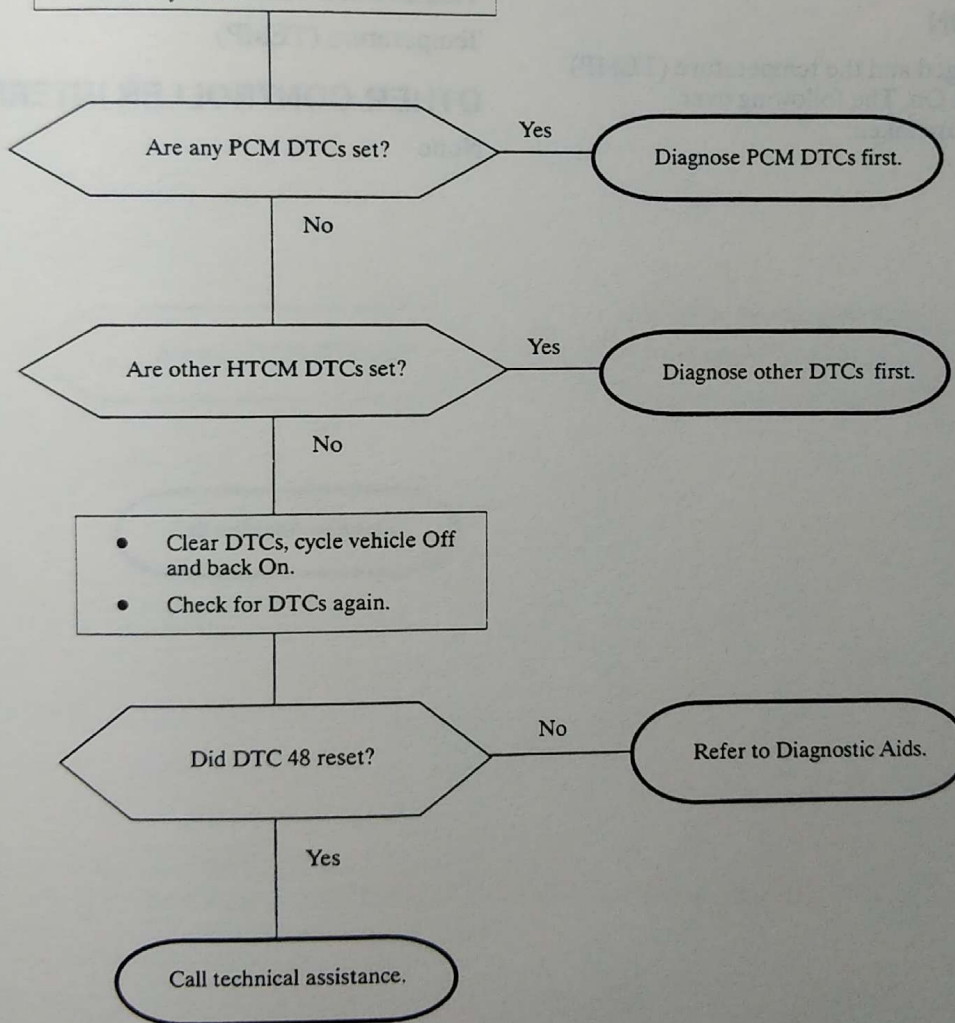
If the problem is intermittent, wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

DTC 48 DRIVE MOTOR OVER TEMPERATURE

- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record all current and history DTCs.



DTC 49 – POWER INVERTER MODULE OVER TEMPERATURE

The temperature sensors are thermistors that change resistance with temperature change. The sensors have higher resistance as they get colder, lower resistance as temperatures increase. The propulsion control module (PCM) monitors the power inverter modules (PIM) temperature, and reports the PIM temperature to the HTCM over the serial data interface. If the PCM reports that the PIM temperature is excessive, this DTC will be set.

DTC PARAMETERS

DTC 49 will set if:

- Cooling system failure.
- PIM failure.

DTC 49 will set when:

Anytime the HTCM is awake. This fault exists if the PIM temperature (as reported by the PCM) exceeds 79°C (174.2°F).

FAILURE ACTION

This DTC will be logged and the temperature (TEMP) telltale will be turned On. The following over temperature actions are taken:

- FEF and coolant pump are forced to high speed (14.5V).
- The coolant valve is forced to the radiator position.
- The heat pump is disabled.
- Regenerative braking is disabled.

RELATED DTCS

PCM 34, HTCM 50, 54

TELLTALE ILLUMINATED:

Temperature (TEMP)

OTHER CONTROLLER INTERFACES

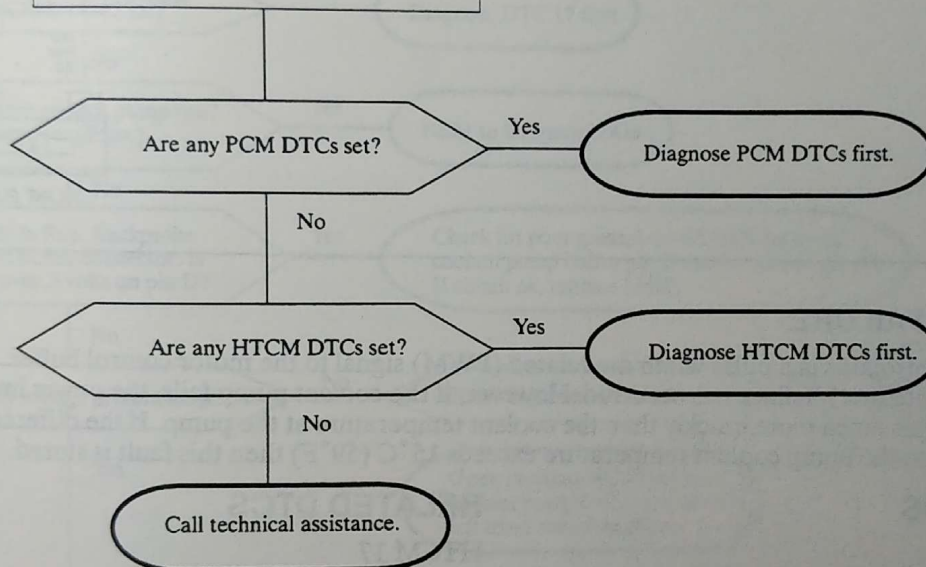
None

DTC 49 POWER INVERTER MODULE OVER TEMPERATURE

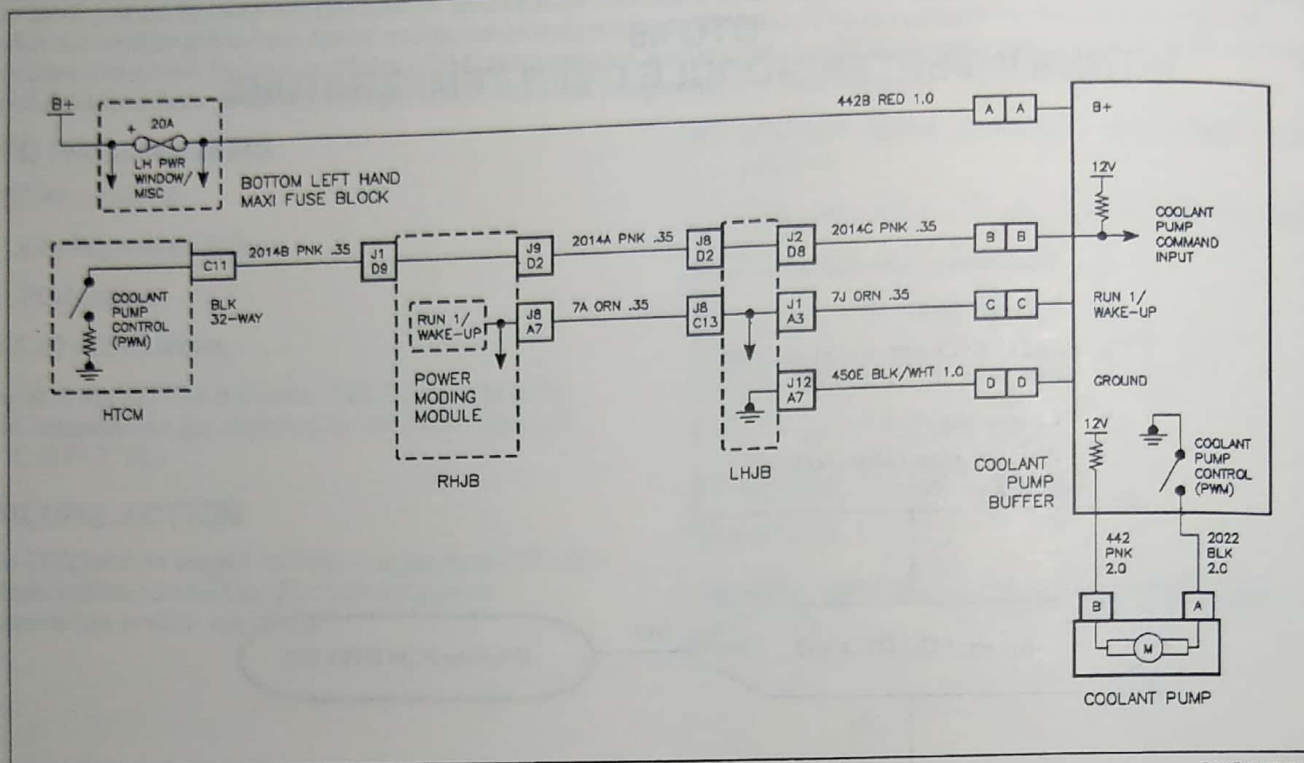
- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record all current and history DTCs.



DTC 50 – COOLANT PUMP FAILURE



PSMELC58346AA

COOLANT PUMP FAILURE

The coolant pump is controlled via a pulse width modulated (PWM) signal to the motor control buffer. There is no direct feedback to indicate that a failure has occurred. However, if the coolant pump fails, the power inverter module (PIM) will heat up much more quickly than the coolant temperature at the pump. If the difference between the PIM temperature and the pump coolant temperature exceeds 15°C (59°F) then this fault is stored.

DTC PARAMETERS

DTC 50 will set if:

- Circuit 7, 450E, 2014C or 442B fault.
- Coolant pump buffer failure.
- Coolant pump failure.

DTC 50 will set when:

Anytime the HTCM is awake, after the first minute of operation. This fault logic is ignored for one minute after powerup to allow the temperature to equalize. This fault exists if the PIM temperature is 15°C (59°F) greater than the coolant temperature.

FAILURE ACTION

This DTC will be logged and the temperature (TEMP) telltale will be turned On. In addition, both the rear defogger and the cabin blower are disabled (shed). Finally, the following over temperature actions are taken:

- The heat pump is disabled.
- Charging is disabled while in Run.
- Regenerative braking is disabled.

RELATED DTCS

HTCM 17

TELLTALE ILLUMINATED:

SERVICE SOON

OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

This DTC may set in high temperatures if the vehicle is driven aggressively (wide open throttle operation and/or up steep inclines). If the DTC was set under these conditions, it may be considered normal.

This DTC may set if the pump coolant temperature sensor value becomes skewed. This condition may be checked by allowing the vehicle to soak to ambient temperature (this usually takes about three hours) and comparing the various temperature sensor readings using the scan tool*. The sensors should read within three degrees of each other.

*Select General Information from the Scan tool HTCM menu.

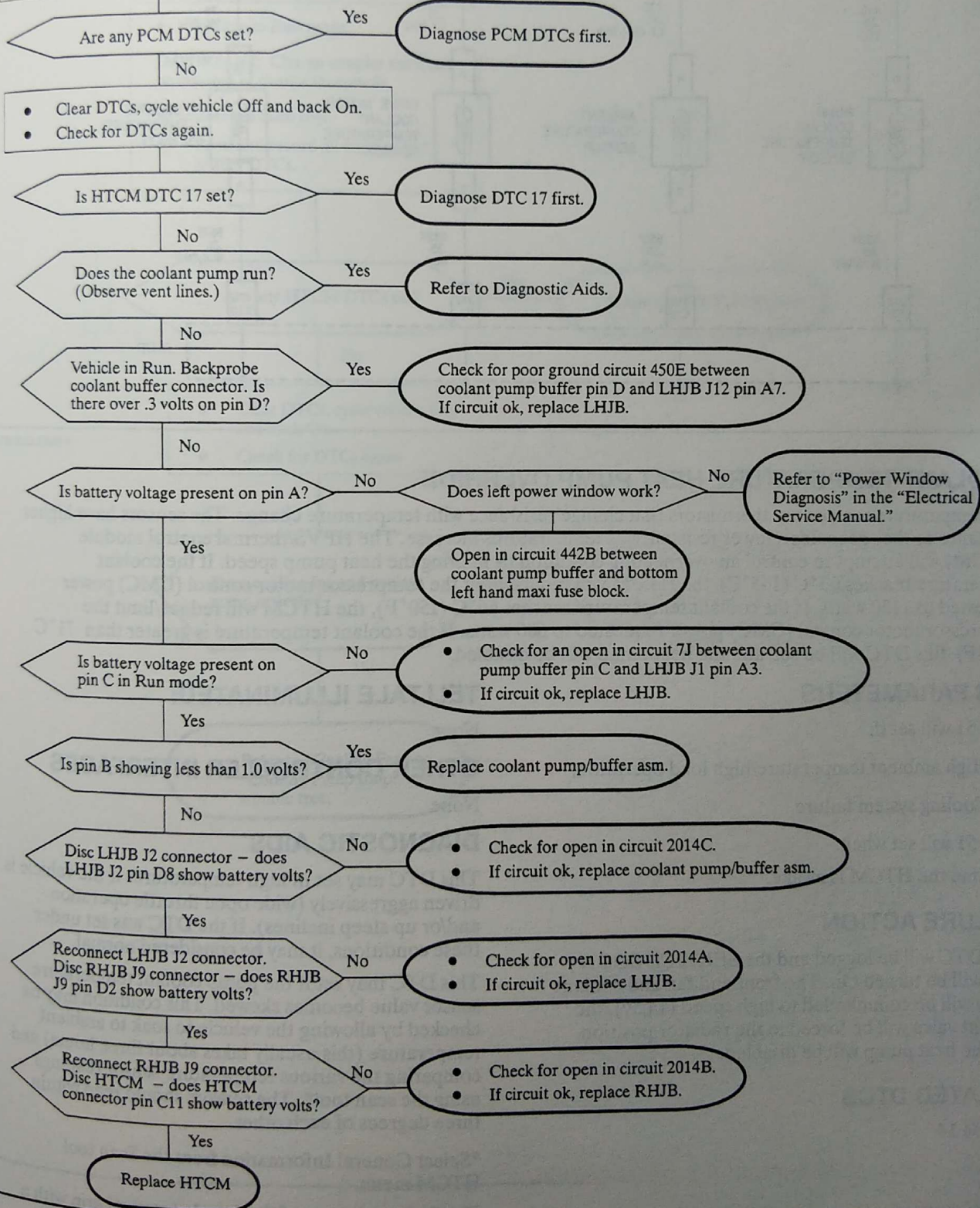
Check the tightness of the female terminal grip with a spare male terminal.

DTC 50 COOLANT PUMP FAILURE

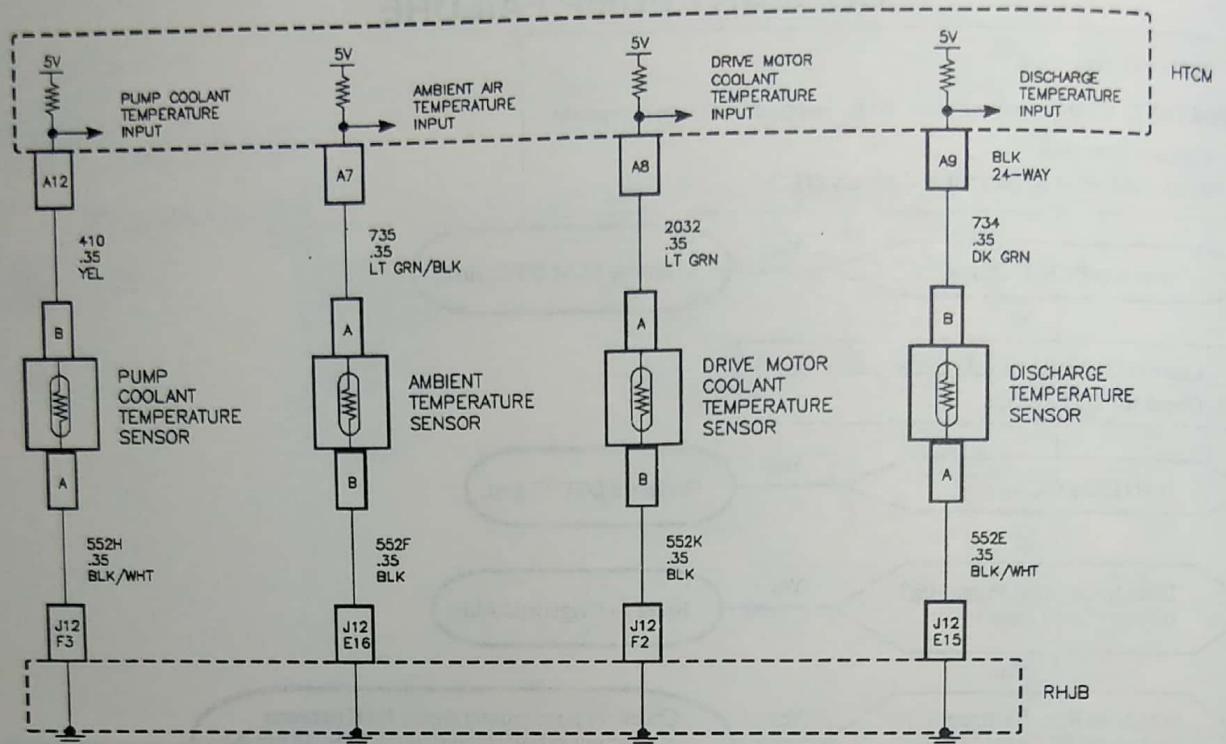
- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record all current and history DTCs.



DTC 51 – COOLANT TEMPERATURE HEAT PUMP OVERRIDE



PSMELC68181AA

COOLANT TEMPERATURE HEAT PUMP OVERRIDE

The temperature sensors are thermistors that change resistance with temperature change. The sensors have higher resistance as they get colder, lower resistance as temperatures increase. The HPVS/thermal control module (HTCM) will attempt to control an overheating condition by limiting the heat pump speed. If the coolant temperature reaches 63°C (145°F), the HTCM will reduce/limit the compressor motor control (CMC) power requested to 1150 watts. If the coolant temperature reaches 66°C (150°F), the HTCM will reduce/limit the compressor motor control (CMC) power requested to 600 watts. If the coolant temperature is greater than 71°C (160°F), this DTC will be set, and the heat pump will be disabled.

DTC PARAMETERS

DTC 51 will set if:

- High ambient temperature/high load operation.
- Cooling system failure.

DTC 51 will set when:

Anytime the HTCM is awake.

FAILURE ACTION

This DTC will be logged and the SERVICE SOON light will be turned On. The front end fan and coolant pump will be commanded to high speed (14.5v), the coolant valve will be forced to the radiator position, and the heat pump will be disabled.

RELATED DTCS

HTCM 14

TELLTALE ILLUMINATED:

None

OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

This DTC may set in high temperatures if the vehicle is driven aggressively (wide open throttle operation and/or up steep inclines). If the DTC was set under these conditions, it may be considered normal.

This DTC may set if the pump coolant temperature sensor value becomes skewed. This condition may be checked by allowing the vehicle to soak to ambient temperature (this usually takes about three hours) and comparing the various temperature sensor readings using the scan tool*. The sensors should read within three degrees of each other.

*Select General Information from the Scan tool HTCM menu.

Check the tightness of the female terminal grip with a spare male terminal.

DTC 51 COOLANT TEMPERATURE HEAT PUMP OVERRIDE

- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record all current and history DTCs.

Are any HTCM DTCs set?

Yes

Diagnose HTCM DTCs first.

No

- Clear DTCs, cycle vehicle Off and back On.
- Check for DTCs again.

Does cooling fan and coolant pump operate?

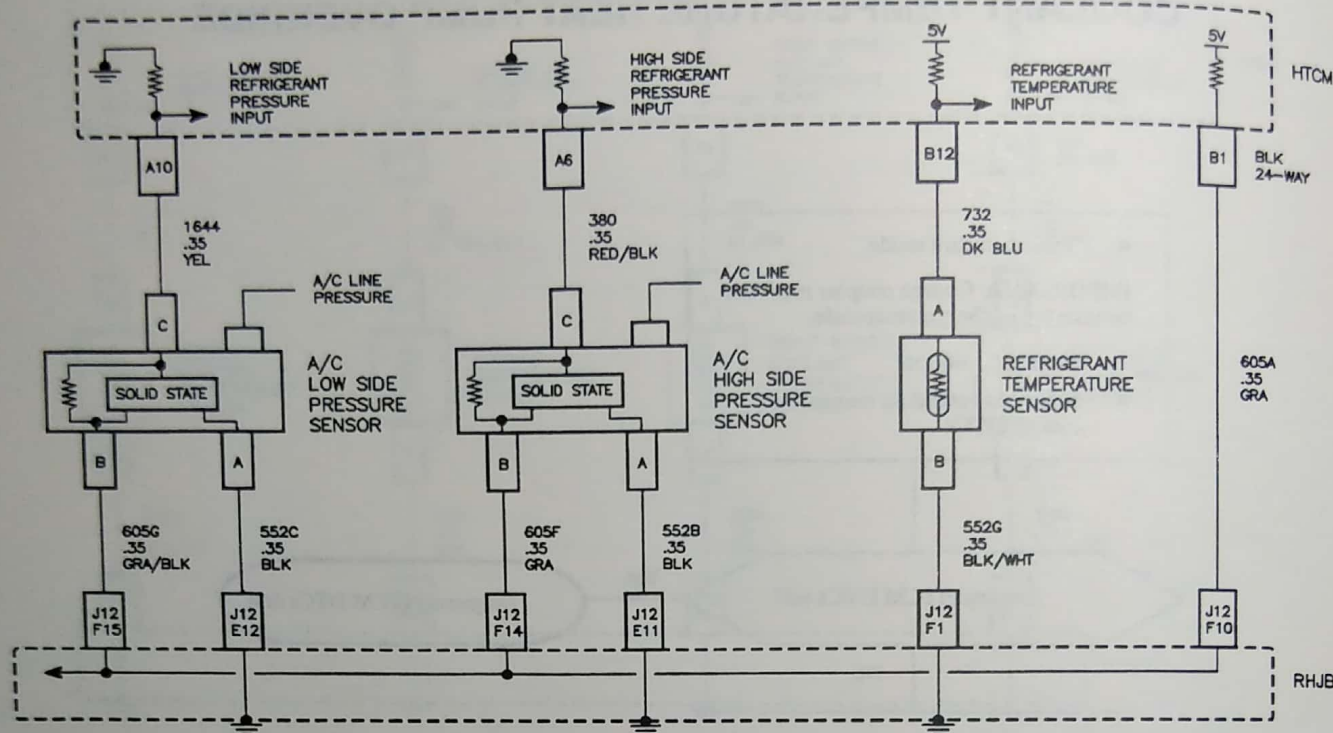
Yes

Refer to "Cooling System Performance Check."

No

Refer to "Cooling Fan" or "Cooling Pump Inop." trouble tree.

DTC 52 – LOW SIDE PRESSURE THRESHOLD EXCEEDED



PSMELC68180AA

LOW SIDE PRESSURE THRESHOLD EXCEEDED

The pressure transducers convert capacitance change (which varies with pressure changes) to a 0 to 5 volt analog signal. The HPVS/thermal control module (HTCM) monitors input from the transducers. If the input goes below normal, this fault will be set and the heat pump will be disabled.

DTC PARAMETERS

DTC 52 will set if:

- Low refrigerant charge.
- Blocked orifice tube.
- Reversing valve failure.

DTC 52 will set when:

Anytime the HTCM is awake and the heatpump is running. If pressure falls below 20 kPa (3 psi) in heat or DeFox mode or below 100 kPa (14.5 psi) in cool mode.

FAILURE ACTION

This fault will be logged, the SERVICE SOON telltale will be turned On, and heat pump operation will be disabled.

RELATED DTCS

HTCM 11, 16

TELLTALE ILLUMINATED:

None

OTHER CONTROLLER INTERFACES

None

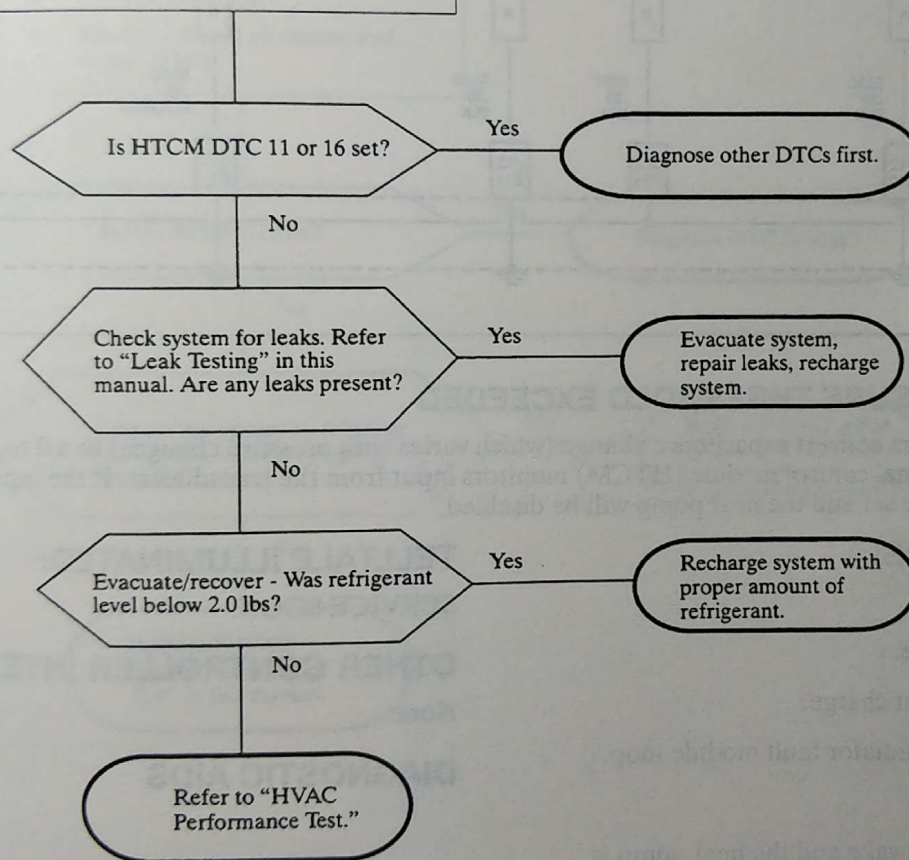
DIAGNOSTIC AIDS

DTC 52 LOW SIDE PRESSURE THRESHOLD EXCEEDED

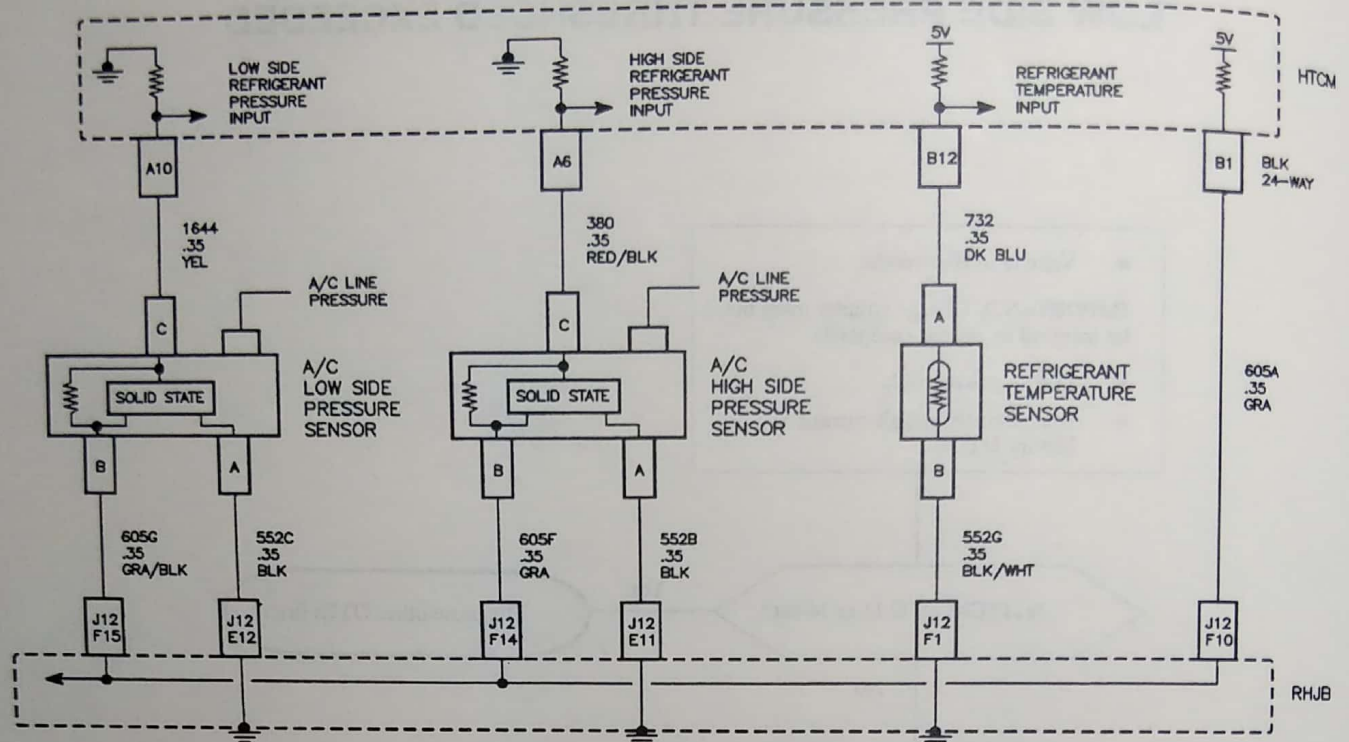
- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record all current and history DTCs.



DTC 53 – HIGH SIDE PRESSURE THRESHOLD EXCEEDED



PSMELC68180AA

HIGH SIDE PRESSURE THRESHOLD EXCEEDED

The pressure transducers convert capacitance change (which varies with pressure changes) to a 0 to 5 volt analog signal. The HPVS/thermal control module (HTCM) monitors input from the transducers. If the input goes above normal, this fault will be set and the heat pump will be disabled.

DTC PARAMETERS

DTC 53 will set if:

- Blocked orifice tube.
- Excessive refrigerant charge.
- CRFM condenser radiator fault module inop.

DTC 53 will set when:

Anytime the HTCM is awake and the heat pump is running. If pressure rises above 2800 kPa (406 psi), this DTC will set.

FAILURE ACTION

This fault will be logged, the SERVICE SOON telltale will be turned On, and heat pump operation will be disabled.

RELATED DTCS

HTCM 10

TELLTALE ILLUMINATED:

SERVICE SOON.

OTHER CONTROLLER INTERFACES

None

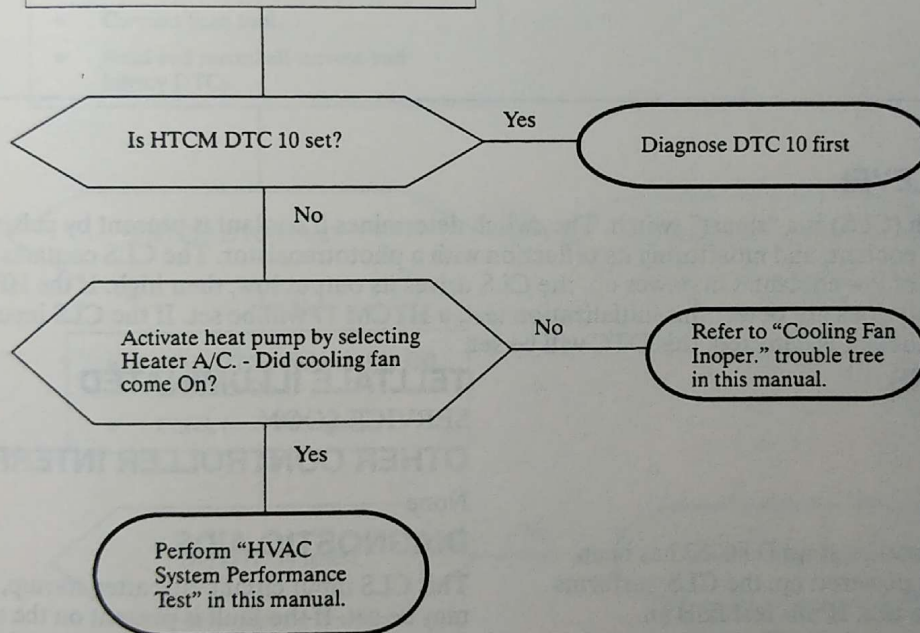
DIAGNOSTIC AIDS

DTC 53 HIGH SIDE PRESSURE THRESHOLD EXCEEDED

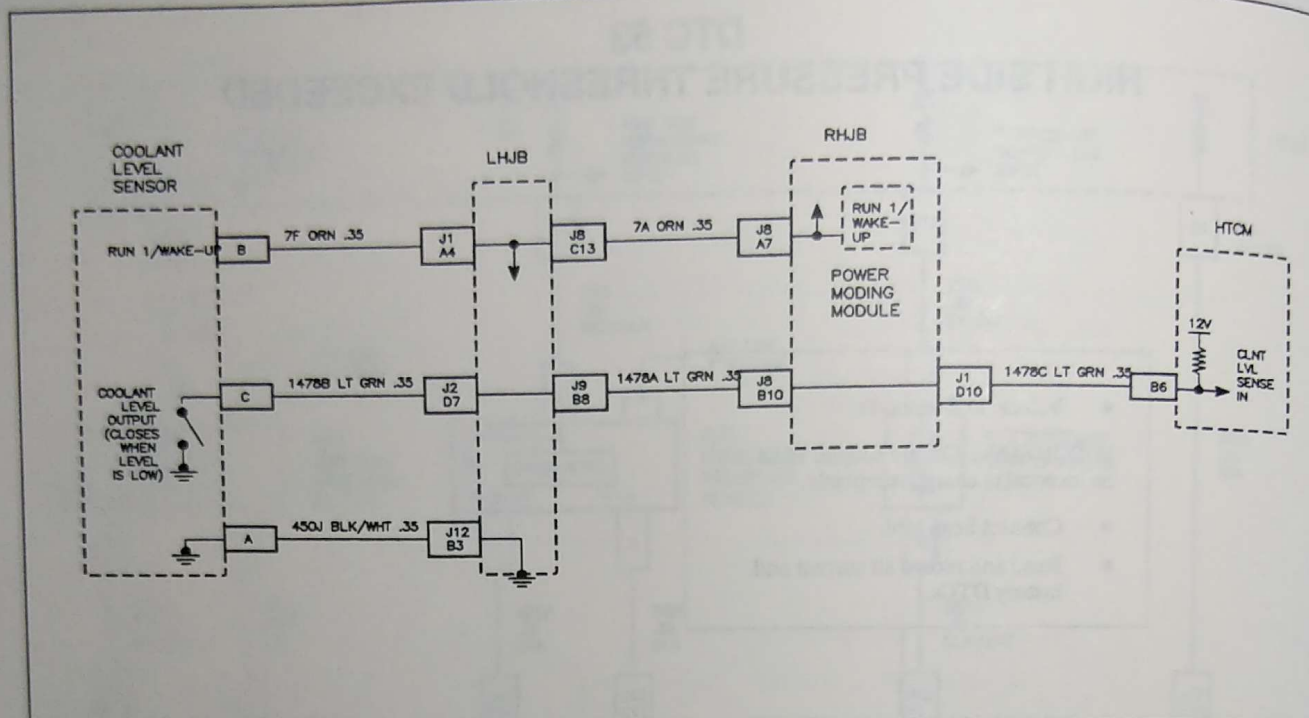
- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record all current and history DTCs.



DTC 54 – LOW COOLANT LEVEL



PSMELC68182AA

LOW COOLANT LEVEL

The coolant level switch (CLS) is a "smart" switch. The switch determines if coolant is present by pulsing a light emitting diode into the coolant, and monitoring its reflection with a phototransistor. The CLS contains filtering to prevent false detection of low coolant. On power up, the CLS drives its output low, then high. If the HPVS/thermal control module (HTCM) does not detect this initialization test, a HTCM 17 will be set. If the CLS input circuit fails after startup, or if low coolant is detected, this DTC will be set.

DTC PARAMETERS

DTC 54 will set if:

- Low coolant level

DTC 54 will set when:

Anytime the HTCM is awake, if no DTC 17 has been set. When the vehicle is powered up, the CLS performs a power up initialization test. If this test fails an HTCM 17 is set. If test passes, the CLS is monitored for coolant level. If the CLS detects low coolant, this fault is set. If the CLS input circuit fails after startup, a 54 may be set. If the fault is present on the next Run cycle, a DTC 17 will be set.

FAILURE ACTION

The SERVICE SOON light will be turned On. Information is passed (via serial data) to the PCM and BPM indicating that the coolant level is low. The following over temperature actions are taken:

- The heat pump is disabled.
- Charging is disabled.
- Preconditioning is disabled.
- Regenerative braking is disabled.

RELATED DTCS

HTCM 17, BPM 296

TELLTALE ILLUMINATED

SERVICE SOON.

OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

This CLS input circuit fails after startup, a DTC 54 may be set. If the fault is present on the next RUN cycle, a DTC 17 will be set. If an DTC 54 is found in history only, the following could cause intermittent problems:

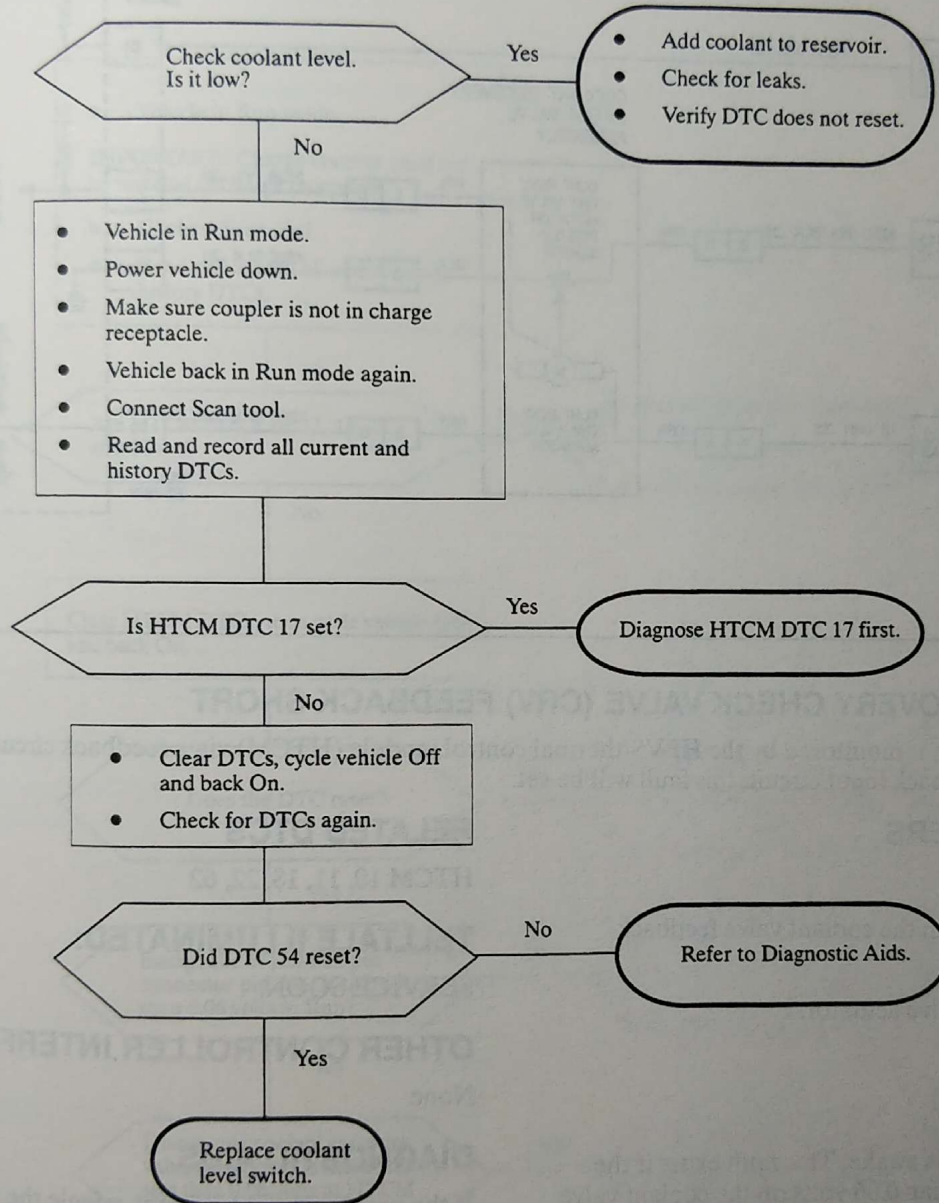
- CLS input circuit open or shorted to voltage or ground.
- CLS Run 1 circuit open or shorted to ground.
- CLS ground circuit open.
- Faulty coolant level sensor.
- HTCM failure.

When attempting to diagnose an intermittent problem, use the Scan tool* and review malfunction history diagnostic information. This data can be used to determine the condition that were present when the DTC set.

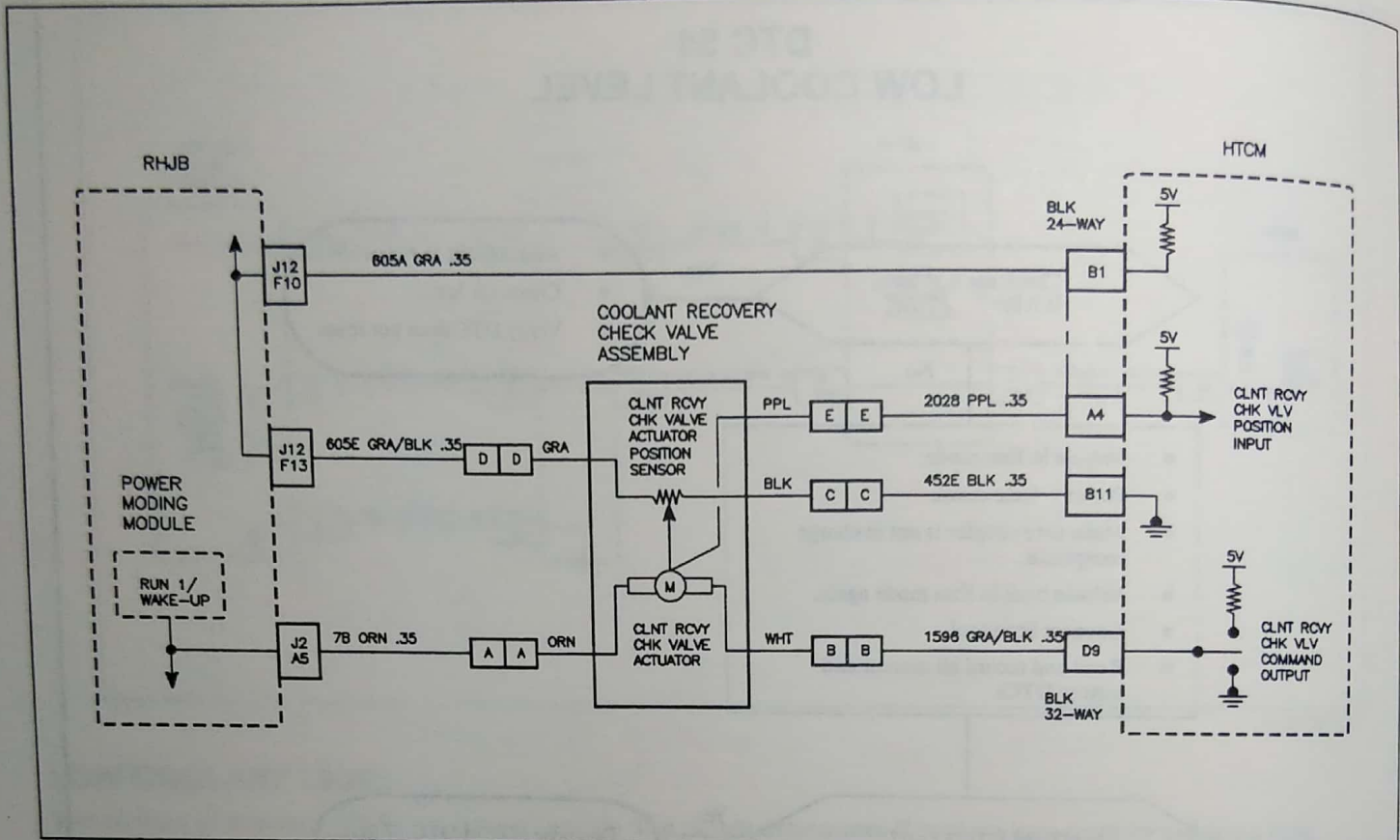
*Select General Information from the Scan tool HTCM menu.

Check the tightness of the female terminal grip with a spare male terminal.

DTC 54 LOW COOLANT LEVEL



DTC 58 – COOLANT RECOVERY CHECK VALVE (CRV) FEEDBACK SHORT



PSMELC68189AA

COOLANT RECOVERY CHECK VALVE (CRV) FEEDBACK SHORT

The actuator position is monitored by the HPVS/thermal control module (HTCM) via a feedback circuit. If a fault is detected on the feedback input circuit, this fault will be set.

DTC PARAMETERS

DTC 58 will set if:

- Short to ground in the coolant valve feedback circuit.
- Faulty coolant valve actuator.
- HTCM failure.

DTC 58 will set when:

Anytime the HTCM is awake. This fault exists if the HTCM detects less than 0.06 volts on the coolant valve feedback input circuit.

FAILURE ACTION

This DTC will be logged, and the SERVICE SOON telltale will be illuminated.

RELATED DTCS

HTCM 10, 11, 18, 22, 62

TELLTALE ILLUMINATED:

SERVICE SOON.

OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

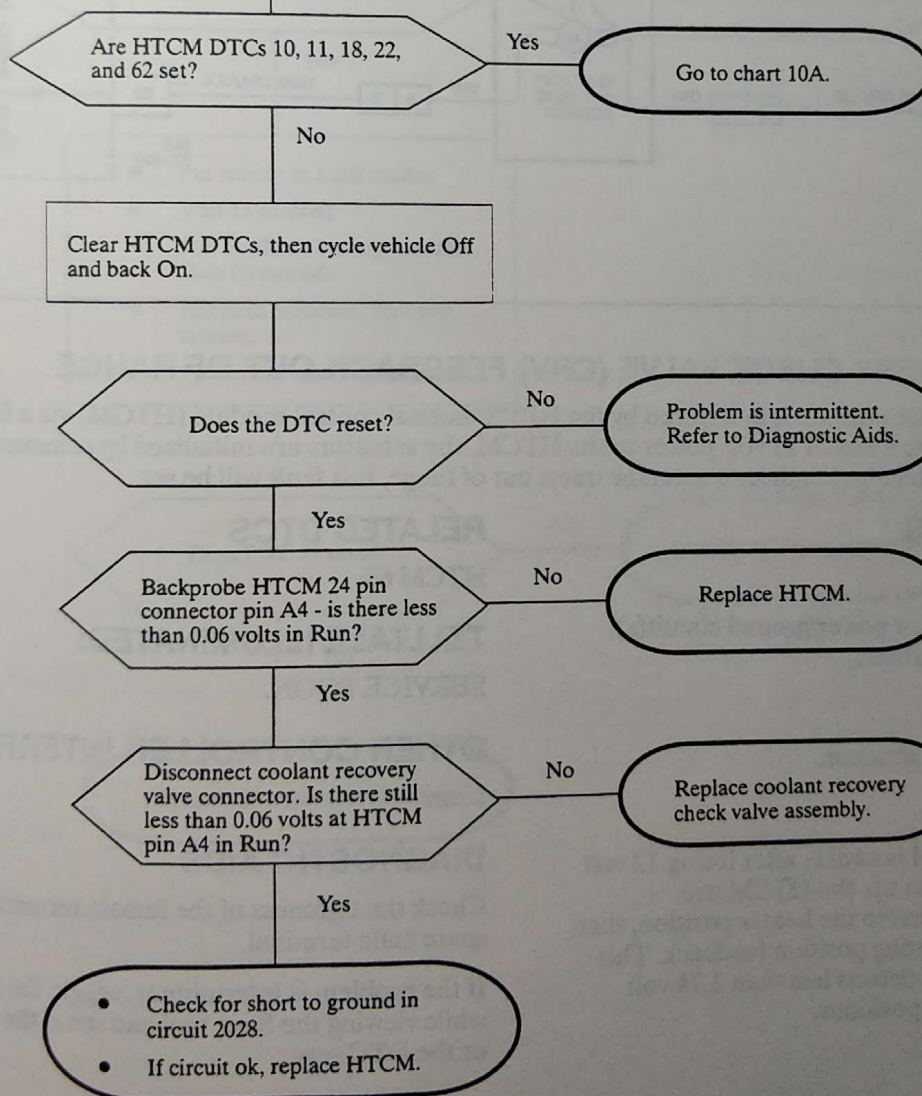
If the problem is intermittent, wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

DTC 58 COOLANT RECOVERY CHECK VALVE (CRV) FEEDBACK SHORT

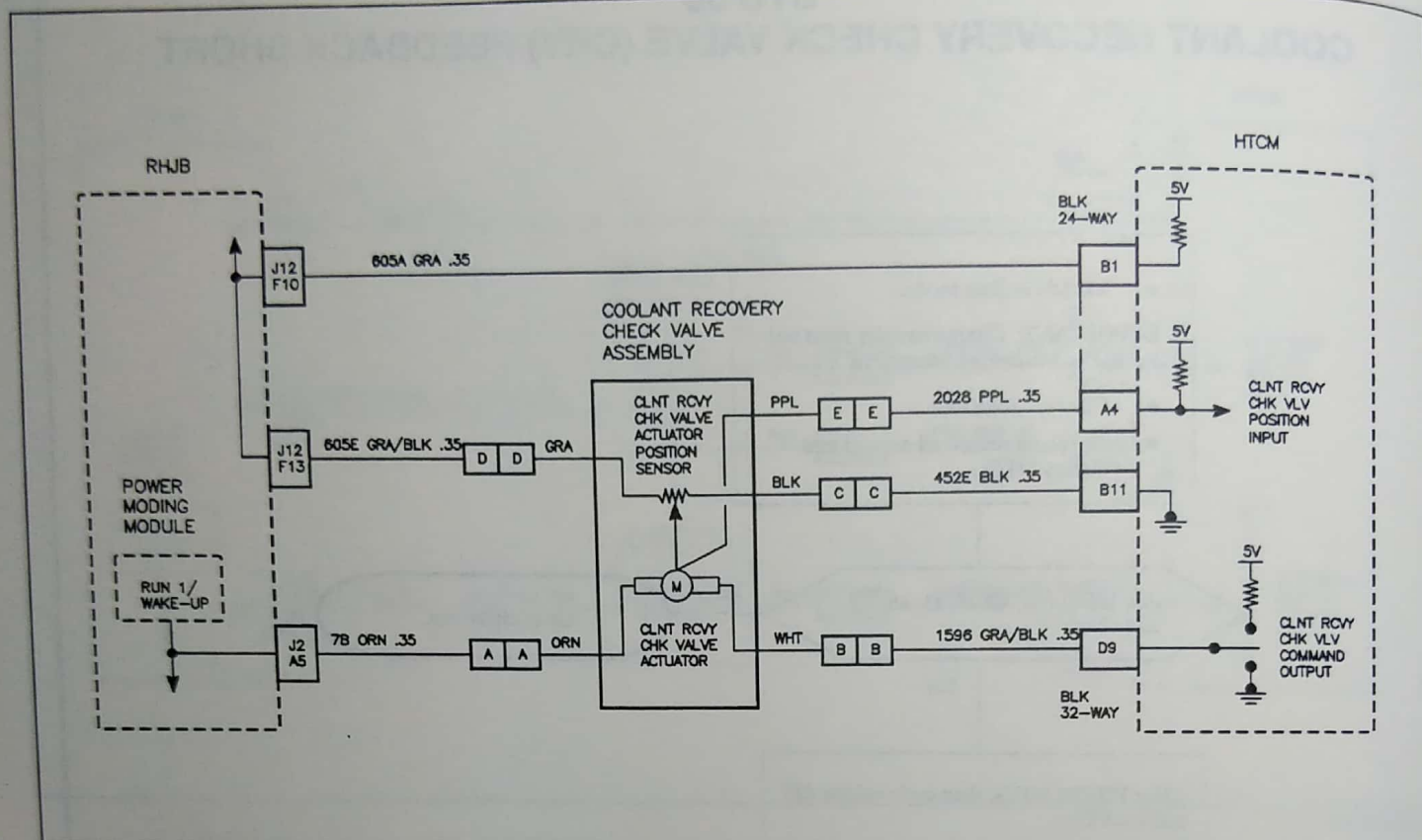
- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record all current and history DTCs.



DTC 59 – COOLANT RECOVERY CHECK VALVE (CRV) FEEDBACK OUT OF RANGE



PSMELC68189AA

COOLANT RECOVERY CHECK VALVE (CRV) FEEDBACK OUT OF RANGE

The coolant valve actuator position is monitored by the HPVS/thermal control module (HTCM) via a feedback circuit. On power up after a loss of 12 volt power to the HTCM, the actuators are initialized by commanding travel to both positions. If the feedback indicates actuator travel out of range, this fault will be set.

DTC PARAMETERS

DTC 59 will set if:

- Coolant valve actuator power/ground circuit(s) open or shorted to ground.
- Mechanical binding.
- Faulty coolant valve actuator.

DTC 59 will set when:

The first time the HTCM is awake, after losing 12 volt power. On this first power up, the HTCM will command the actuator first to the heater position, then to radiator, while monitoring position feedback. This fault exists if the HTCM detects less than 3.74 volt change between the two positions.

FAILURE ACTION

This DTC will be logged, and the SERVICE SOON telltale will be illuminated.

RELATED DTCS

HTCM 60

TELLTALE ILLUMINATED:

SERVICE SOON.

OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

Check the tightness of the female terminal grip with a spare male terminal.

If the problem is intermittent, wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

DTC 59 COOLANT RECOVERY CHECK VALVE (CRV) FEEDBACK OUT OF RANGE

- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record all current and history DTCs.

Is HTCMT DTC 60 set?

Yes

Refer to HTCMT DTC 60.

No

- Put vehicle in Lock mode.
- Wait 15 seconds.
- Pull auxilliary battery maxifuse. Wait 20 seconds.
- Reinstall maxifuse. Wait one minute.
- Put vehicle back in Run mode.

Does DTC 59 reset?

No

Vehicle operating normally.

Yes

Replace valve actuator assembly.

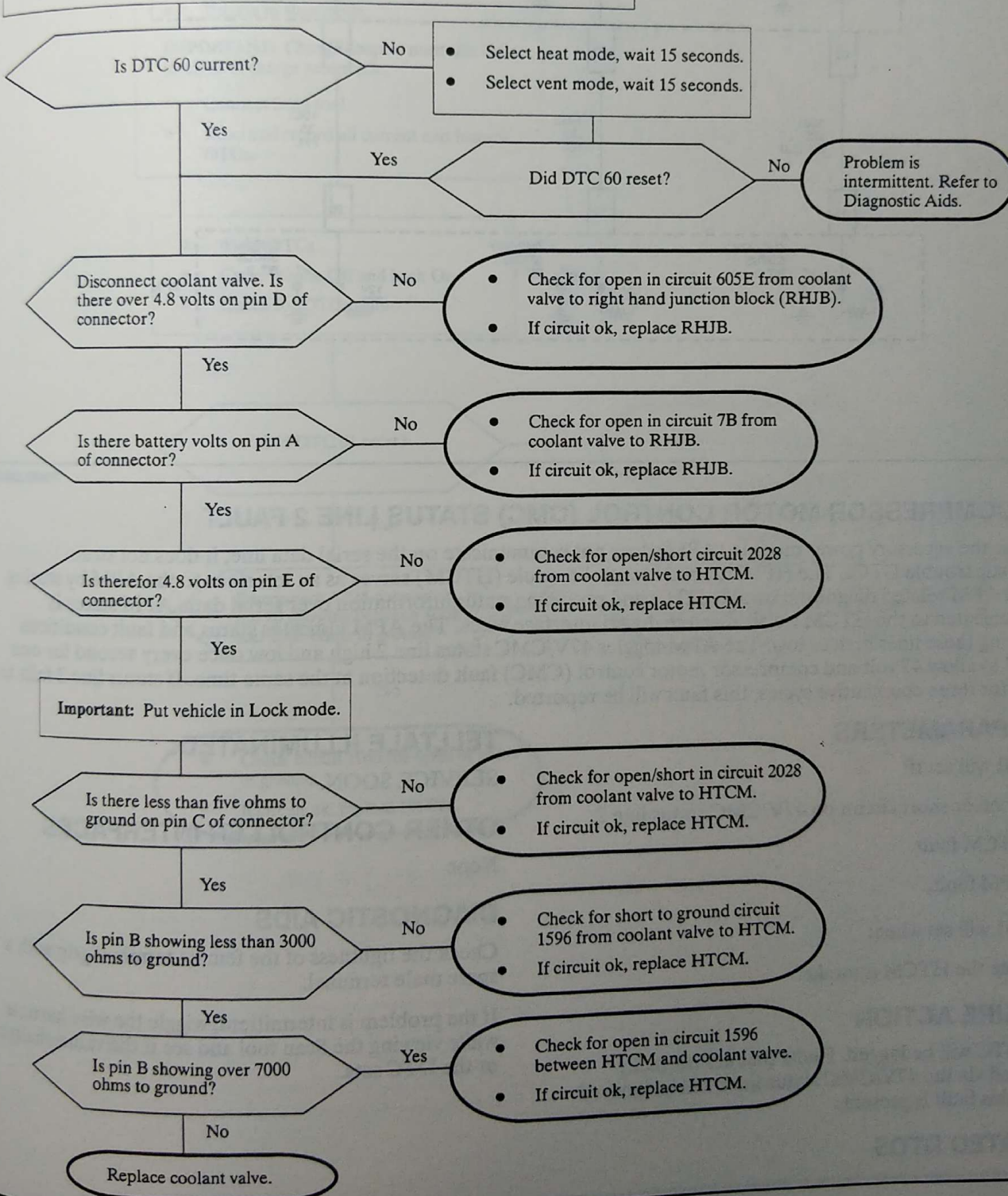


DTC 60 COOLANT RECOVERY CHECK VALVE (CRV) NOT RESPONDING

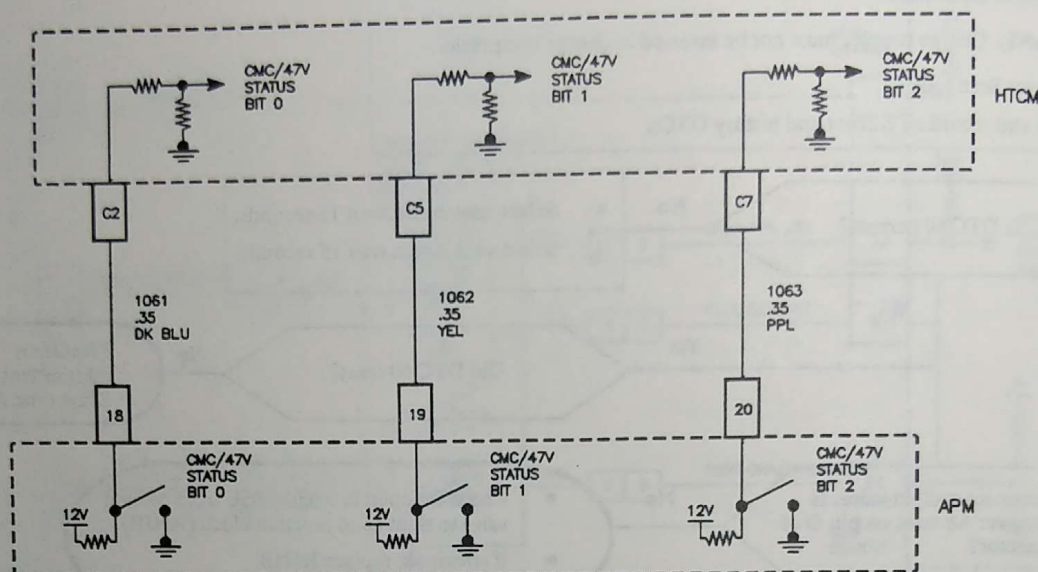
- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record all current and history DTCs.



DTC 61 – 47V/COMPRESSOR MOTOR CONTROL (CMC) STATUS LINE 2 FAULT



PSMELC68190AA

47V/COMPRESSOR MOTOR CONTROL (CMC) STATUS LINE 2 FAULT

Because the accessory power module (APM) does not communicate on the serial data line, it does not store diagnostic trouble DTCs. The HPVS/thermal control module (HTCM) serves as an interface to the APM by storing several APM related diagnostic trouble DTCs and providing status information over serial data. APM status is communicated to the HTCM via six discrete digital interface wires. The APM indicates status and fault conditions by driving these lines high or low. The APM toggles 47V/CMC status line 2 high and low once every second for one second to allow 47 volt and compressor motor control (CMC) fault detection at the same time. If status line 2 fails to toggle for three consecutive cycles, this fault will be reported.

DTC PARAMETERS

DTC 61 will set if:

- Open or short circuit on 47V/CMC status line 2.
- HTC fault.
- APM fault.

DTC 61 will set when:

Anytime the HTC is awake.

FAILURE ACTION

This DTC will be logged. Faults that are normally detected via the 47V/CMC status lines will be ignored while this fault is present.

RELATED DTCs

None

TELLTALE ILLUMINATED:

SERVICE SOON.

OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

Check the tightness of the female terminal grip with a spare male terminal.

If the problem is intermittent, wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

DTC 61 47V/COMPRESSOR MOTOR CONTROL (CMC) STATUS LINE 2 FAULT

- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record all current and history DTCs.

- Clear DTCs.
- Cycle vehicle Off and back On.
- Check for DTCs again.

Did DTC 61 reset?

No

Refer to Diagnostic Aids.

Yes

Disconnect APM connector - is pin 20 showing between 100k and 200k ohms to ground?

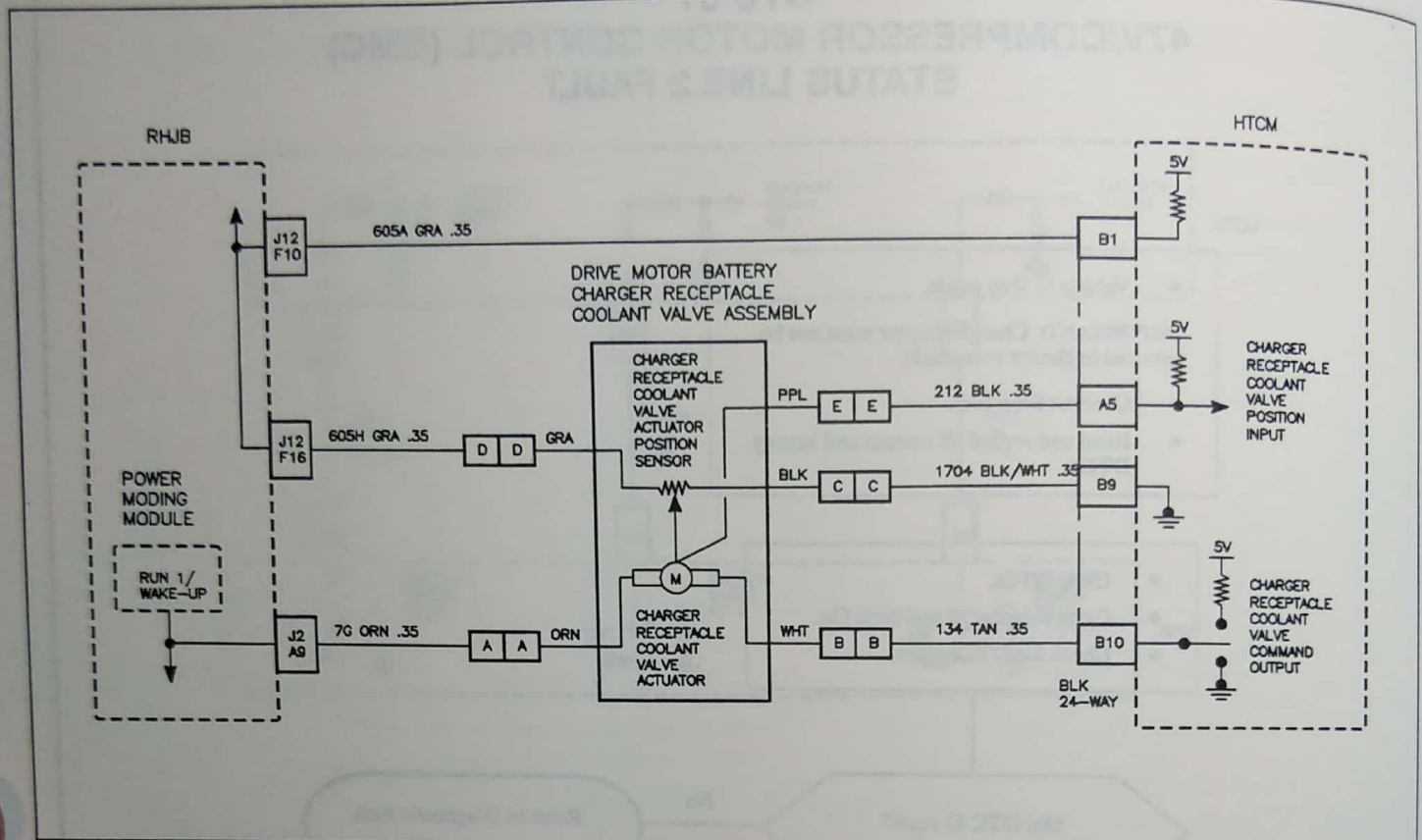
Yes

Replace accessory power module (APM).

No

- Check circuit 1063 for open or short to ground.
- If circuit ok, replace HTCM.

DTC 62 – CHARGER RECEPTACLE COOLANT VALVE (CRCV) FEEDBACK SHORT



PSMELC68191AA

CHARGER RECEPTACLE COOLANT VALVE (CRCV) FEEDBACK SHORT

The actuator position is monitored by the HPVS/thermal control module (HTCM) via a feedback circuit. If a fault is detected on the feedback input circuit, this fault will be set.

DTC PARAMETERS

DTC 62 will set if:

- Short to ground in the charge port valve feedback circuit.
- Valve feedback circuit.
- Faulty charge port valve actuator.
- HTCM failure.

DTC 62 will set when:

Anytime the HTCM is awake. This fault exists if the HTCM detects less than 0.06 volts on the charge port valve feedback input circuit.

FAILURE ACTION

This DTC will be logged, and the SERVICE SOON telltale will be illuminated.

RELATED DTCS

HTCM 10, 11, 18, 22, 58

TELLTALE ILLUMINATED:

SERVICE SOON.

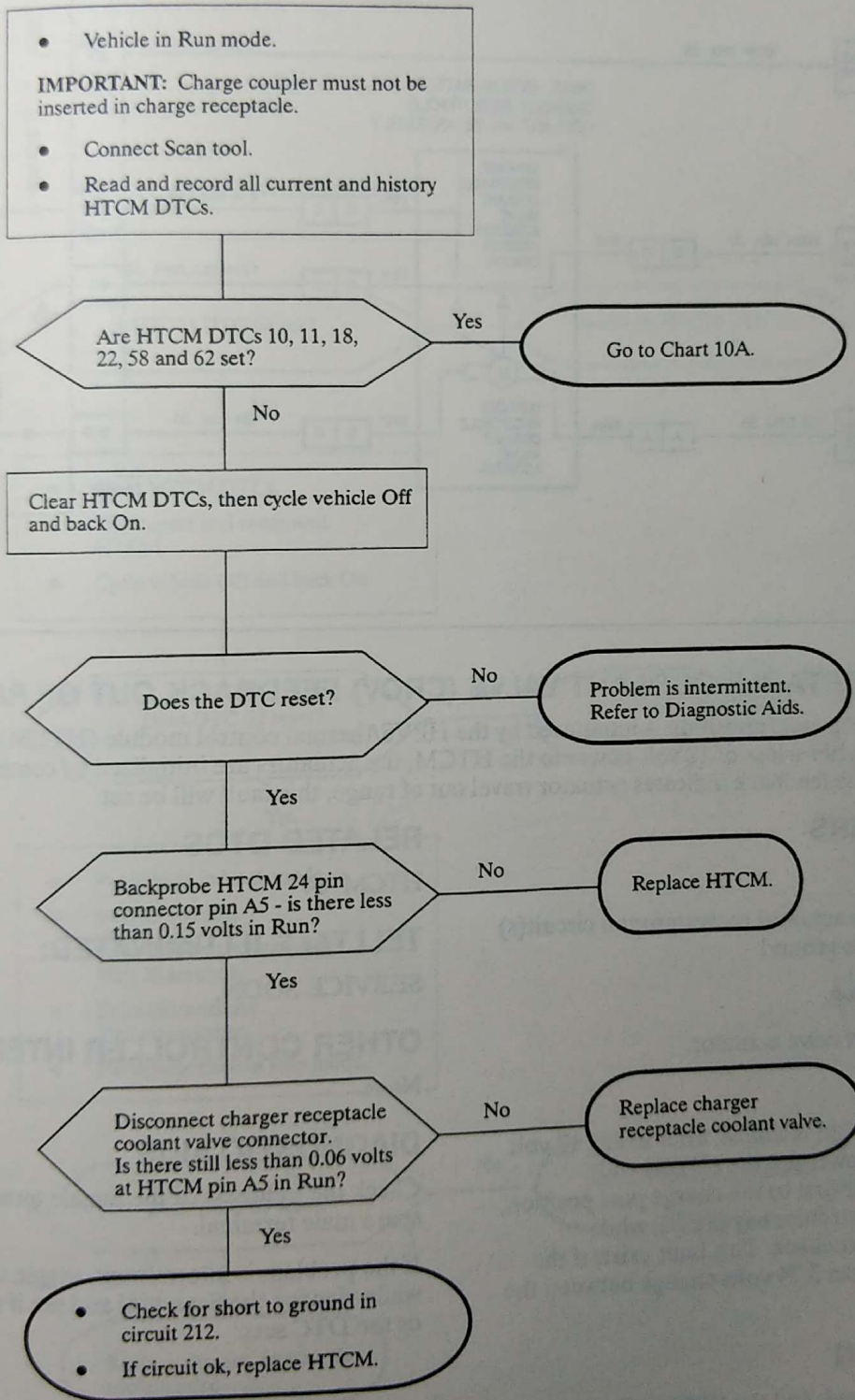
OTHER CONTROLLER INTERFACES

None

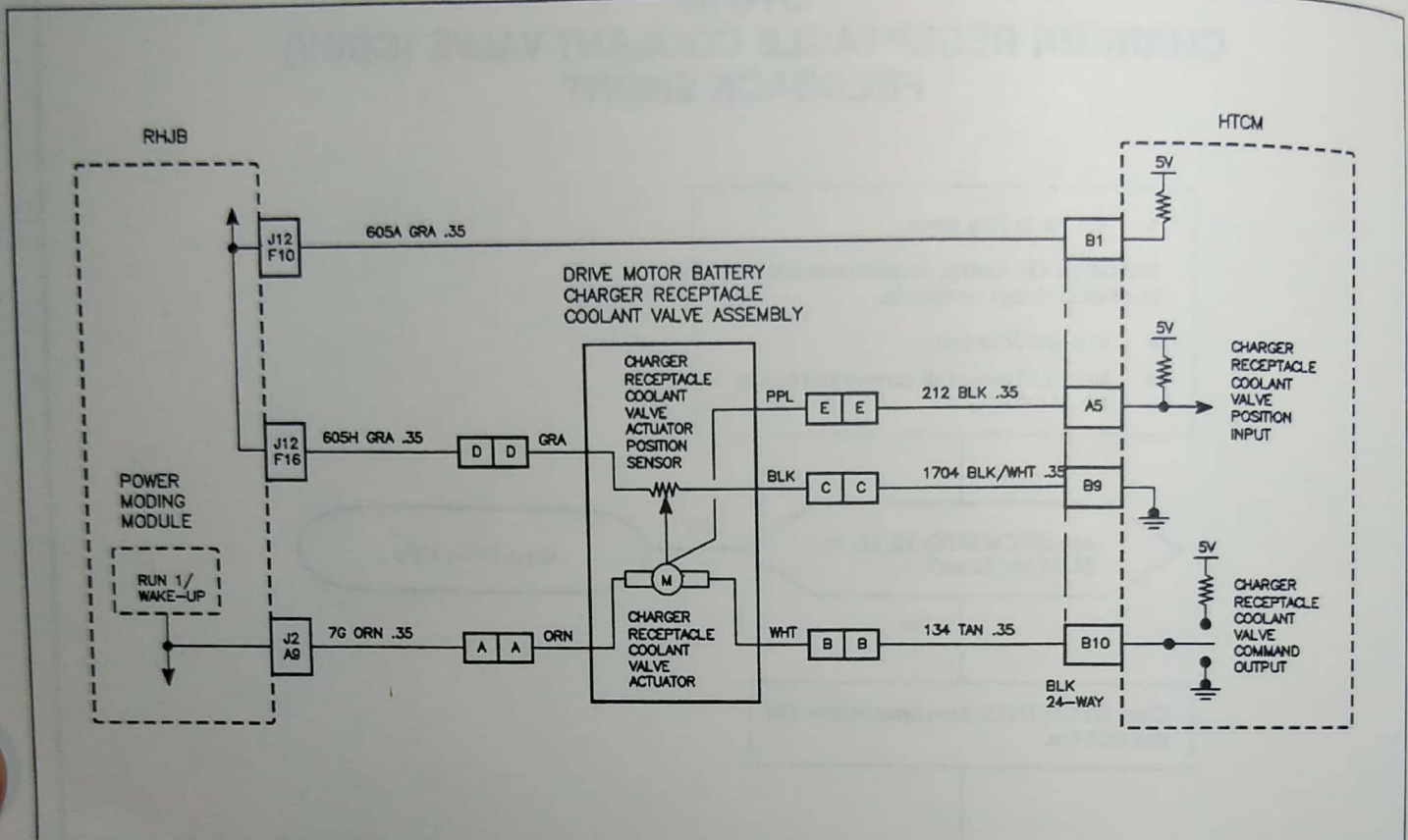
DIAGNOSTIC AIDS

If the problem is intermittent, wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

DTC 62 CHARGER RECEPTACLE COOLANT VALVE (CRCV) FEEDBACK SHORT



DTC 63 – CHARGER RECEPTACLE COOLANT VALVE (CRCV) FEEDBACK OUT OF RANGE



PSMELC68191AA

CHARGER RECEPTACLE COOLANT VALVE (CRCV) FEEDBACK OUT OF RANGE

The charge port valve actuator position is monitored by the HPVS/thermal control module (HTCM) via a feedback circuit. On power up after a loss of 12 volt power to the HTCM, the actuators are initialized by commanding travel to both positions. If the feedback indicates actuator travel out of range, this fault will be set.

DTC PARAMETERS

DTC 63 will set if:

- Charge port valve actuator power/ground circuit(s) open or shorted to ground.
- Mechanical binding.
- Faulty charge port valve actuator.

DTC 63 will set when:

The first time the HTCM is awake, after losing 12 volt power. On this first power up, the HTCM will command the actuator first to the charge port position, then to the power electronics bay (PEB), while monitoring position feedback. This fault exists if the HTCM detects less than 3.74 volts change between the two positions.

FAILURE ACTION

This DTC will be logged, and the SERVICE SOON telltale will be illuminated.

RELATED DTCS

HTCM 64

TELLTALE ILLUMINATED:
SERVICE SOON.

OTHER CONTROLLER INTERFACES

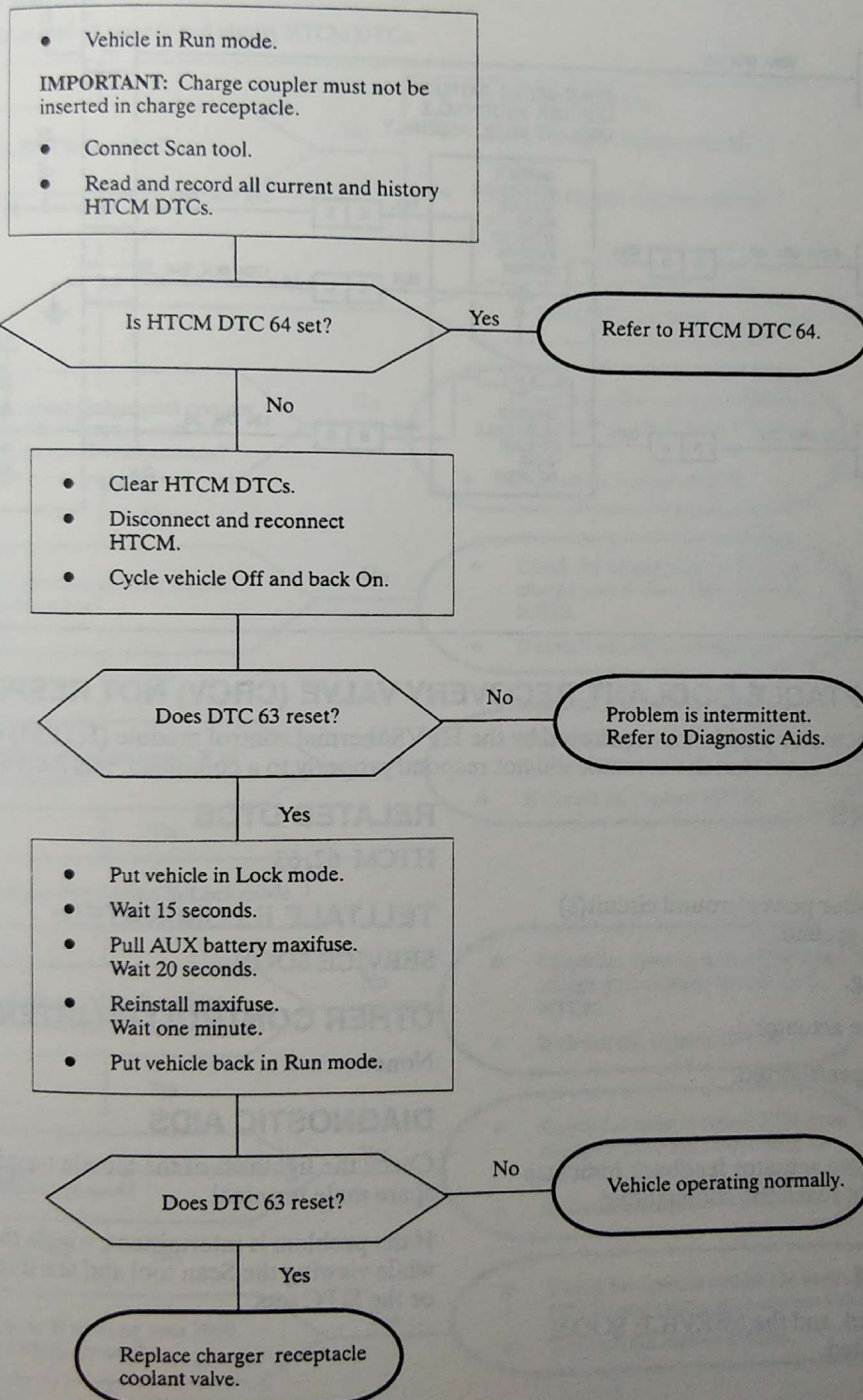
None

DIAGNOSTIC AIDS

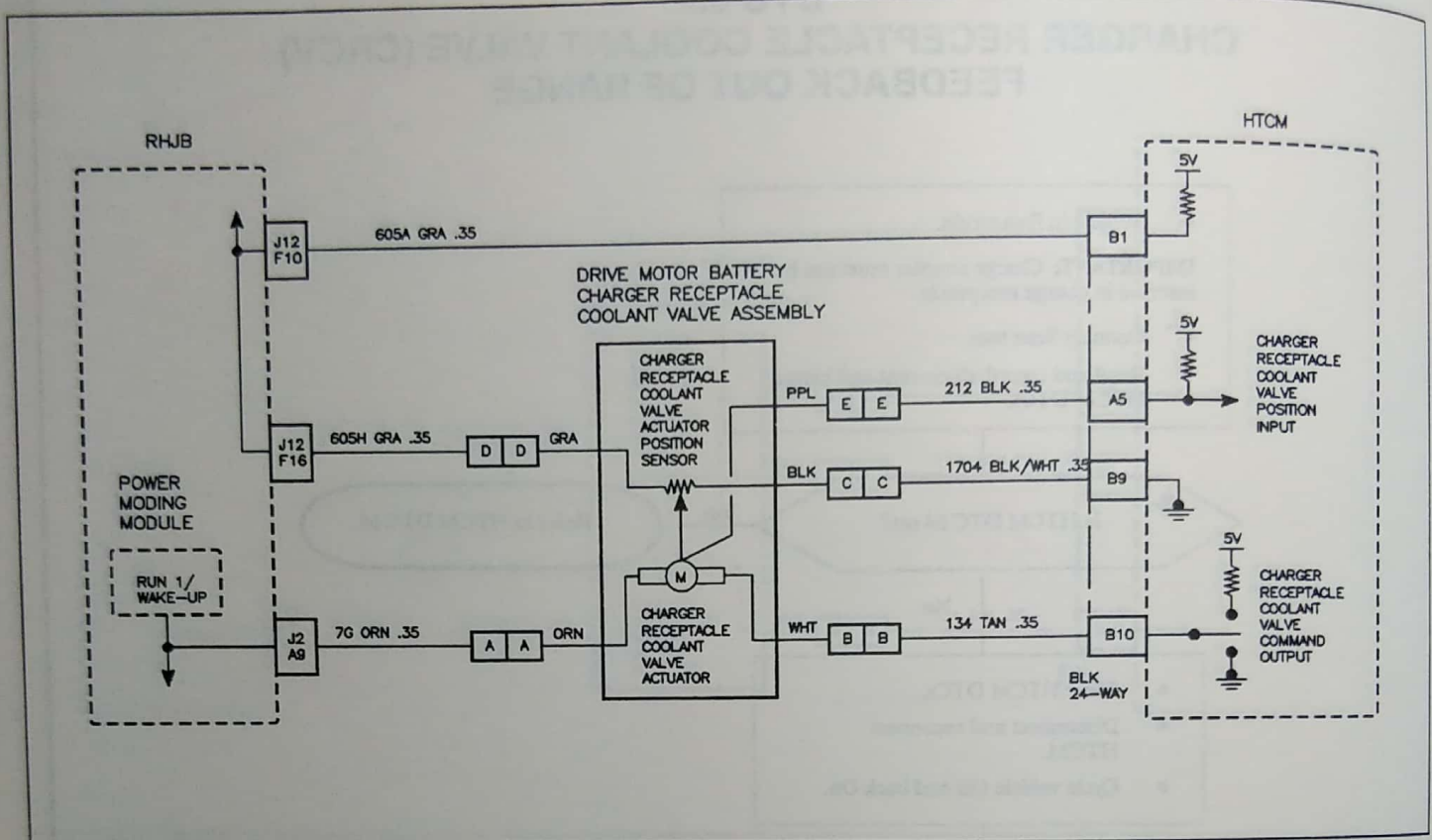
Check the tightness of the female terminal grip with a spare male terminal.

If the problem is intermittent, wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

DTC 63 CHARGER RECEPTACLE COOLANT VALVE (CRCV) FEEDBACK OUT OF RANGE



DTC 64 – CHARGER RECEPTACLE COOLANT RECOVERY VALVE (CRCV) NOT RESPONDING



PSMELC68191AA

CHARGER RECEPTACLE COOLANT RECOVERY VALVE (CRCV) NOT RESPONDING

The charge port valve actuator position is monitored by the HPVS/thermal control module (HTCM) via a feedback circuit. If the feedback indicates that the actuator did not respond properly to a command, this fault will be set.

DTC PARAMETERS

DTC 64 will set if:

- Coolant valve actuator power/ground circuit(s) open or shorted to ground.
- Mechanical binding.
- Faulty coolant valve actuator.
- Feedback circuit open/shorted.

DTC 64 will set when:

Anytime the coolant valve actuator feedback indicates that the actuator did not reach the commanded position.

FAILURE ACTION

This DTC will be logged, and the SERVICE SOON telltale will be illuminated.

RELATED DTCS

HTCM 62, 63

TELLTALE ILLUMINATED:

SERVICE SOON.

OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

Check the tightness of the female terminal grip with a spare male terminal.

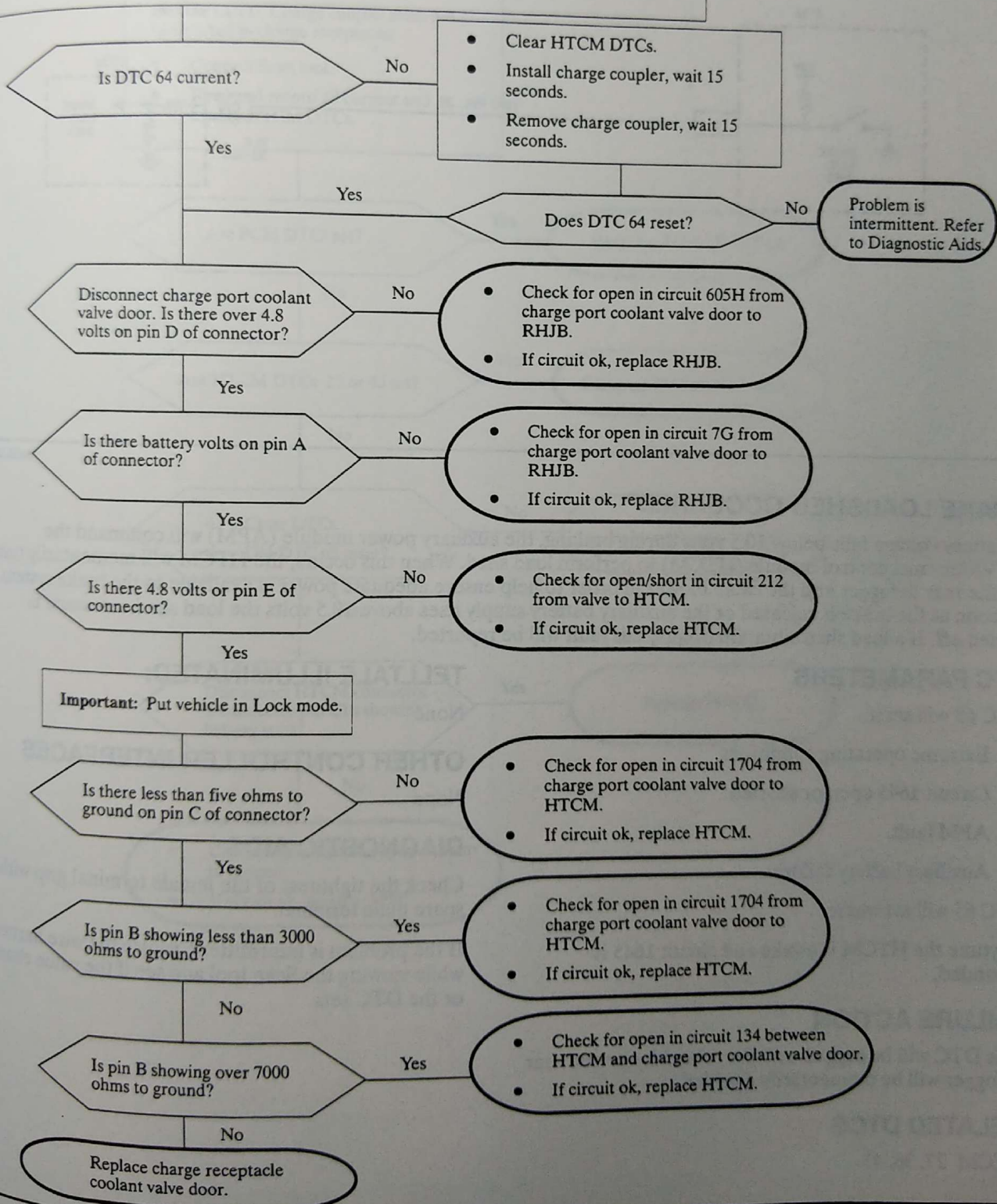
If the problem is intermittent, wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

DTC 64 CHARGER RECEPTACLE COOLANT VALVE (CRCV) NOT RESPONDING

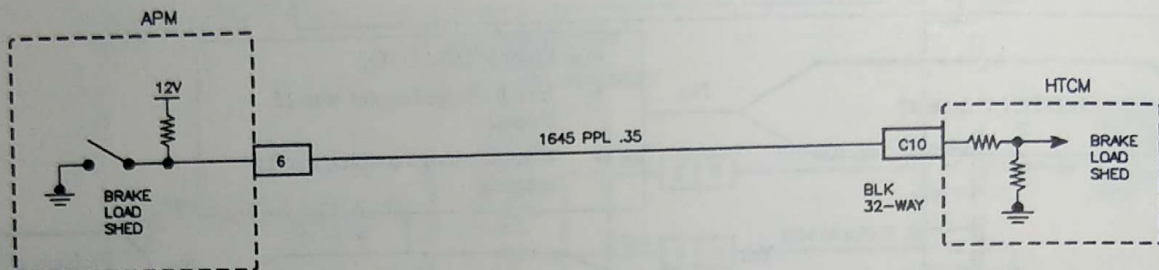
- Vehicle in Run mode.

IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record all current and history HTCM DTCs.



DTC 65 – BRAKE LOADSHED OCCURRED



PSMELC68192AA

BRAKE LOADSHED OCCURRED

If battery voltage falls below 10.5 volts during braking, the auxiliary power module (APM) will command the HPVS/thermal control module (HTCM) to perform load shed. When this occurs, the HTCM will momentarily turn off the rear defogger and the cabin blower in order to help ensure adequate power is available to the brake system. As soon as the brake is released or the auxiliary battery supply rises above 10.5 volts the load shed command is turned off. If a load shed situation occurs, this fault will be reported.

DTC PARAMETERS

DTC 65 will set if:

- Extreme operating conditions.
- Circuit 1645 open or shorted.
- APM fault.
- Auxiliary battery failure.

DTC 65 will set when:

Anytime the HTCM is awake and circuit 1645 is grounded.

FAILURE ACTION

This DTC will be logged, and the cabin blower and rear defogger will be momentarily disabled.

RELATED DTCS

HTCM 27, 38, 43

TELLTALE ILLUMINATED:

None

OTHER CONTROLLER INTERFACES

None

DIAGNOSTIC AIDS

Check the tightness of the female terminal grip with a spare male terminal.

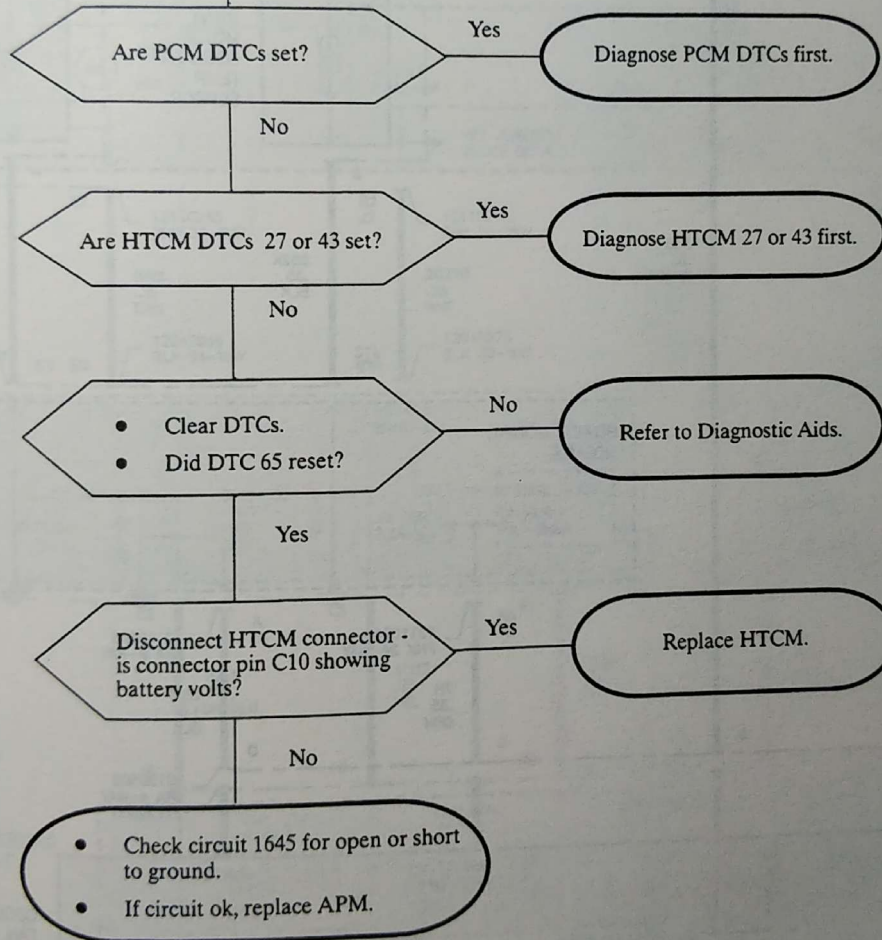
If the problem is intermittent, wiggle the wire harness while viewing the Scan tool and see if the value changes or the DTC sets.

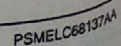
DTC 65 BRAKE LOADSHED OCCURRED

- Vehicle in Run mode.

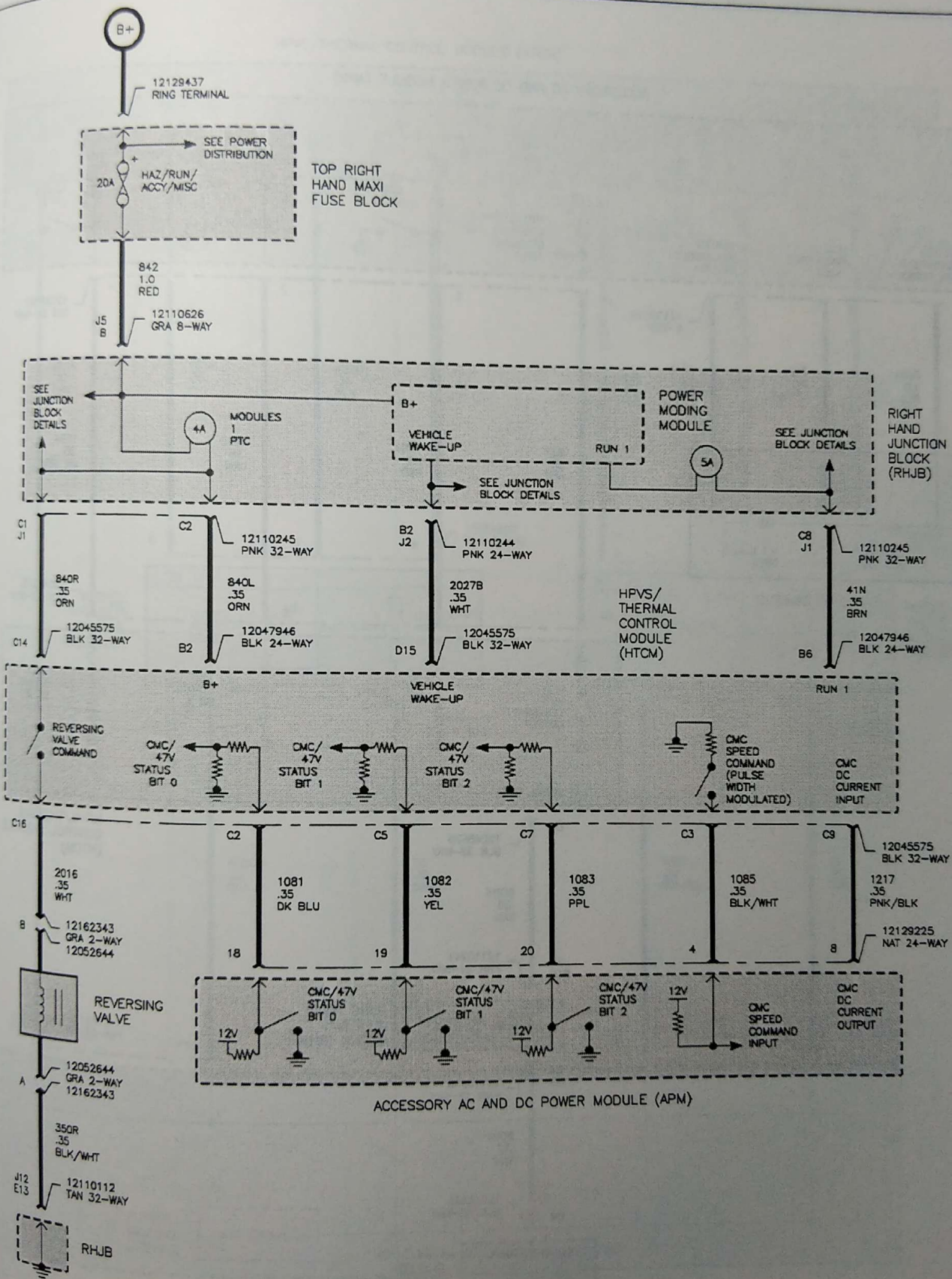
IMPORTANT: Charge coupler must not be inserted in charge receptacle.

- Connect Scan tool.
- Read and record all current and history HTCM DTCs.



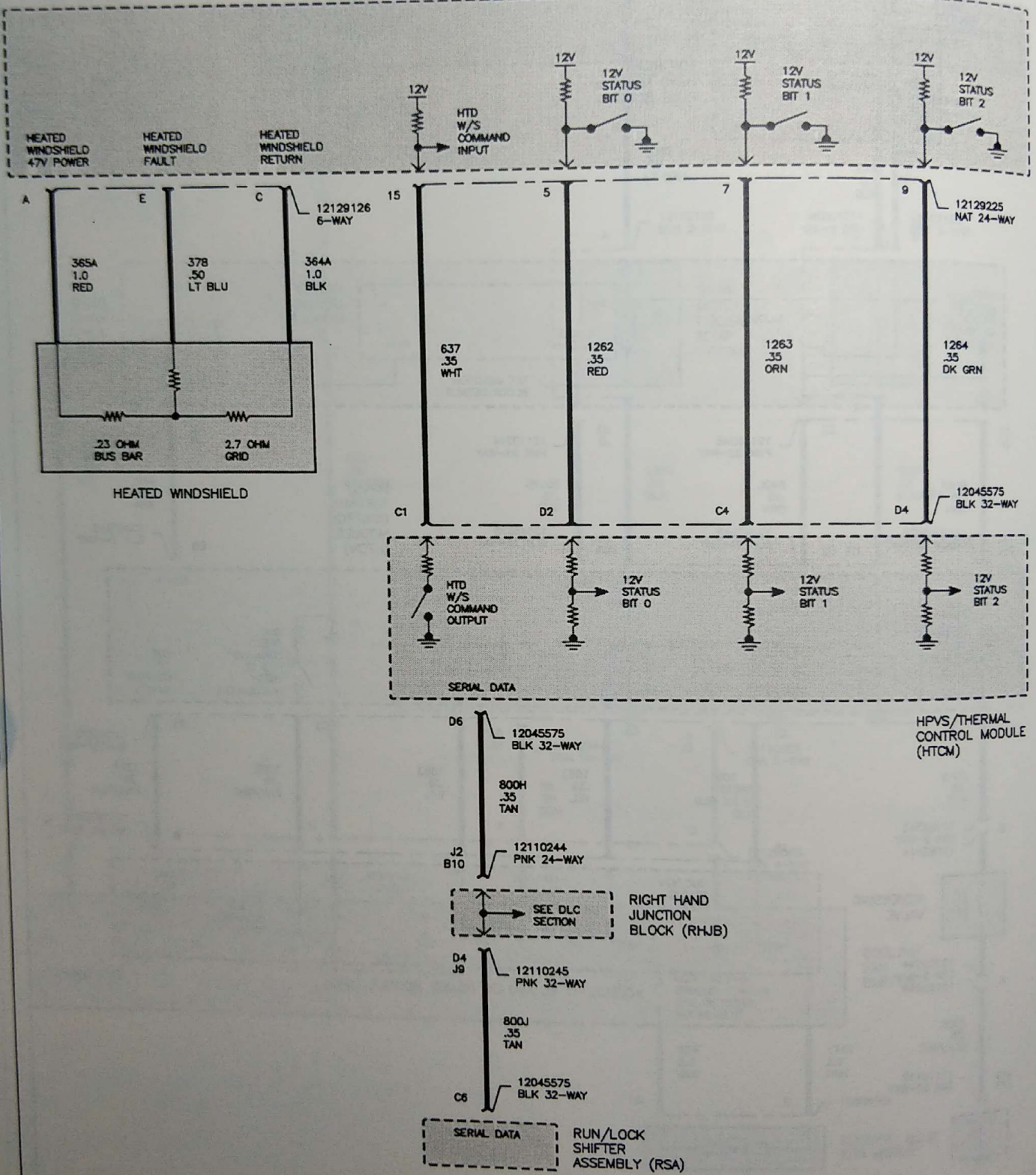


CLIMATE CONTROL

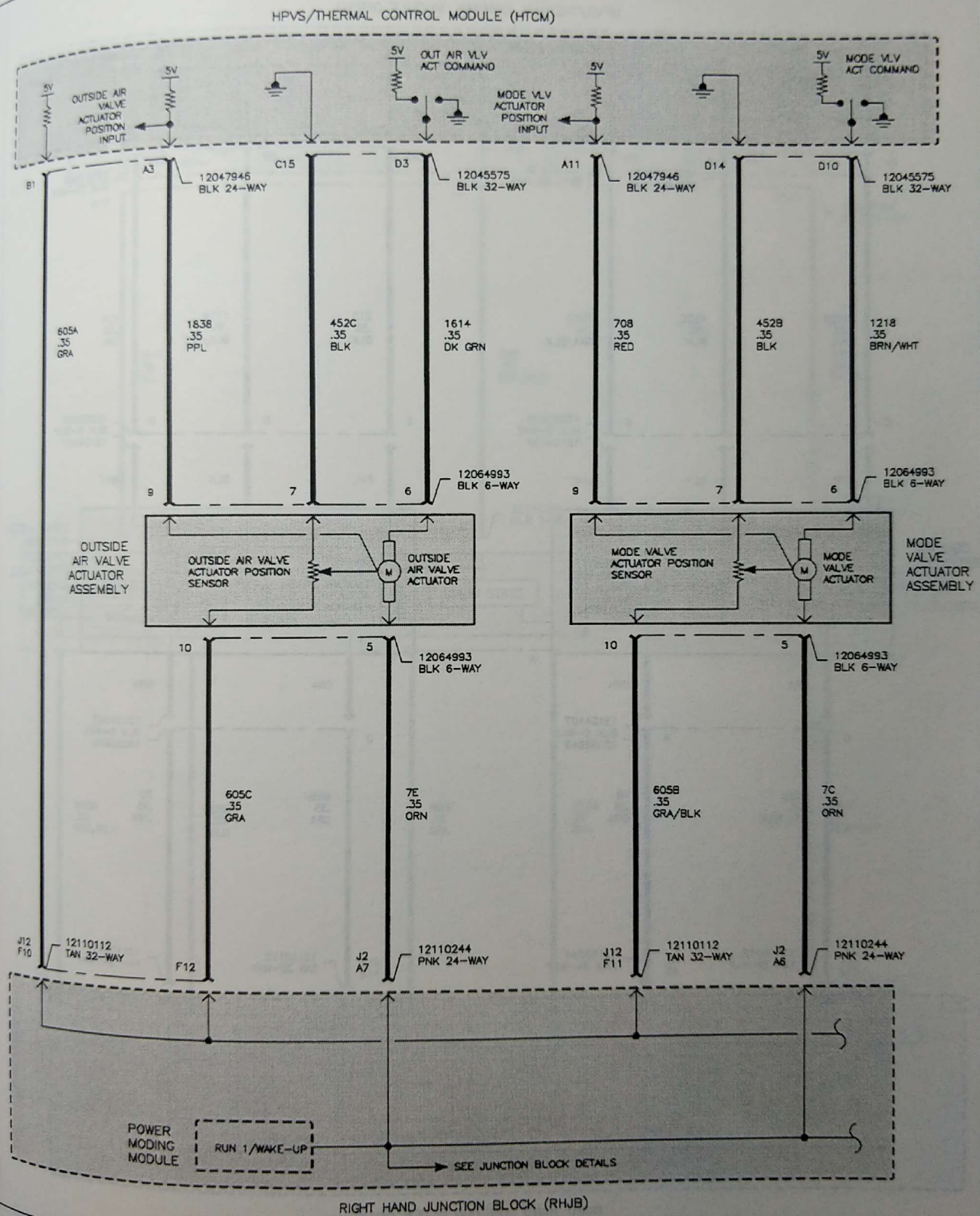


PSMELC68139AA

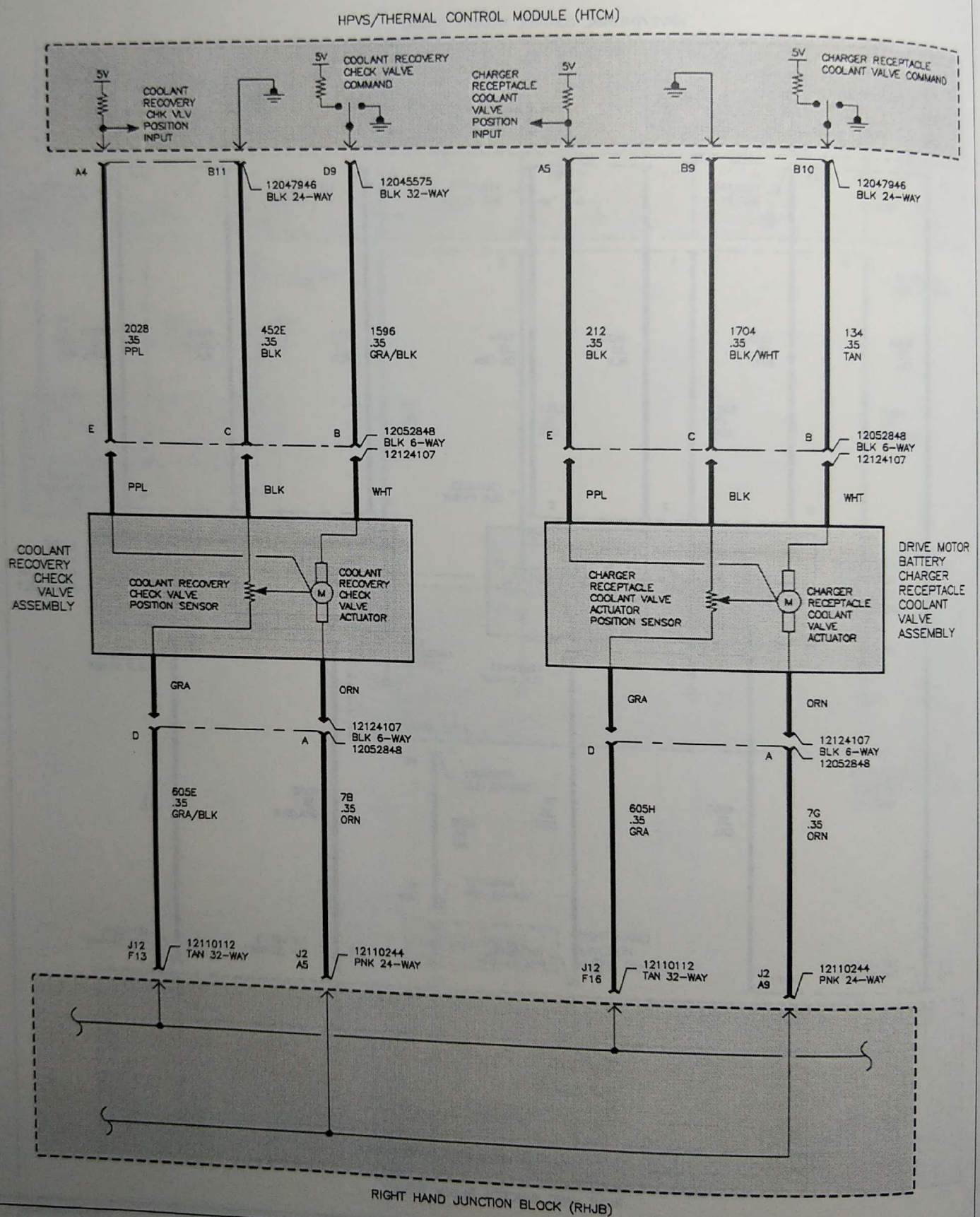
ACCESSORY AC AND DC POWER MODULE (APM)



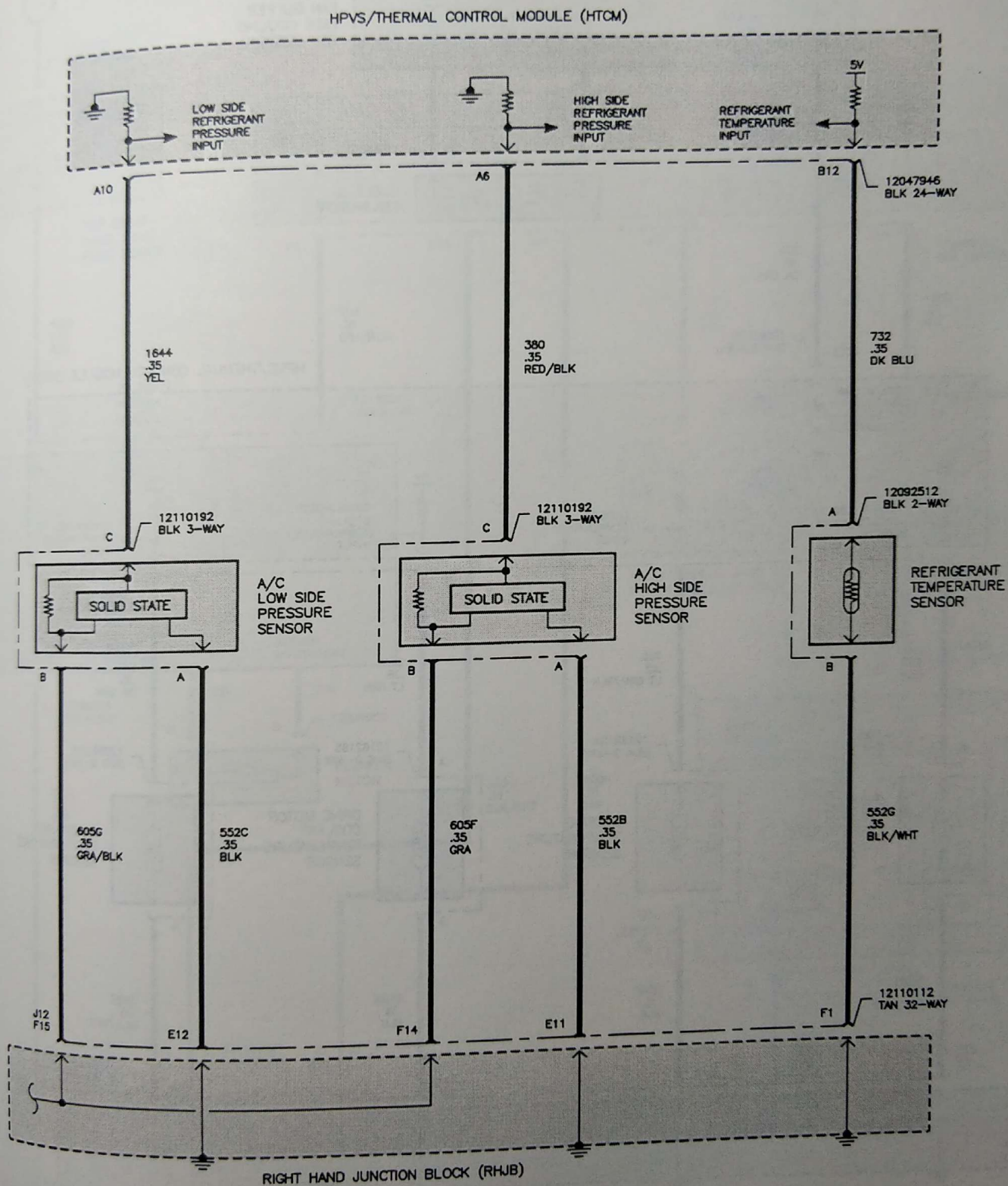
PSMELC68138AA



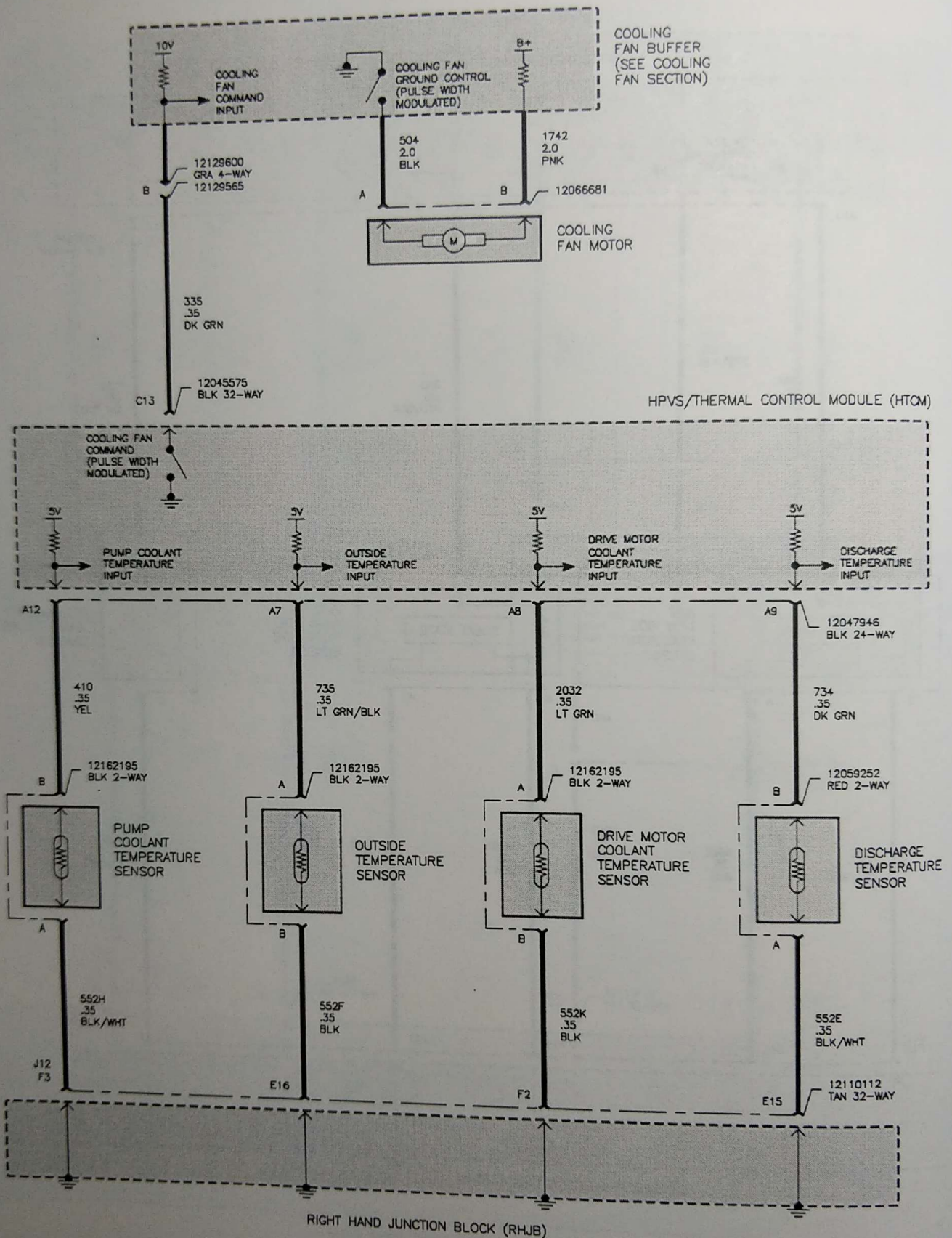
PSMELC68141AA



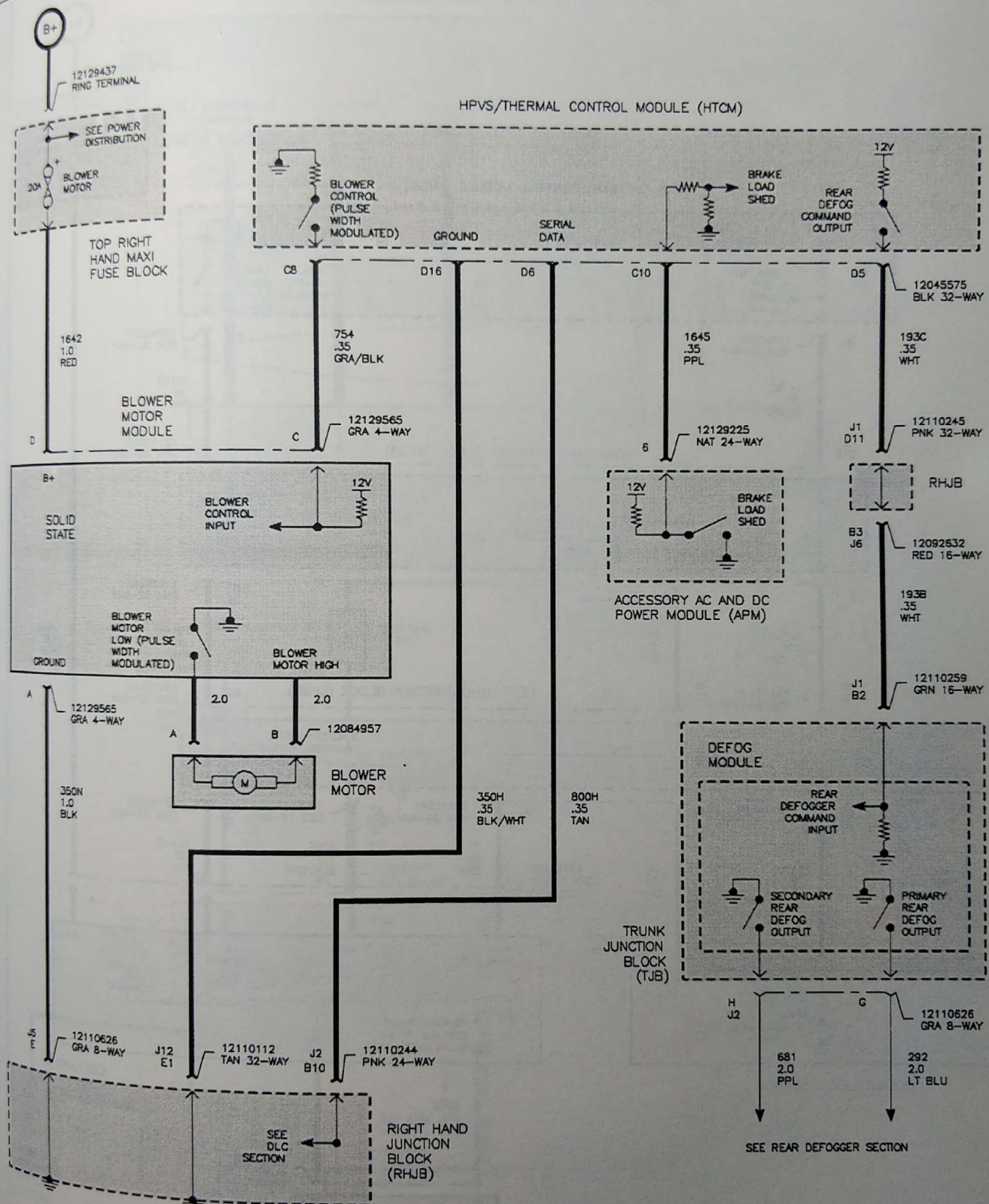
PSMELC68142AC



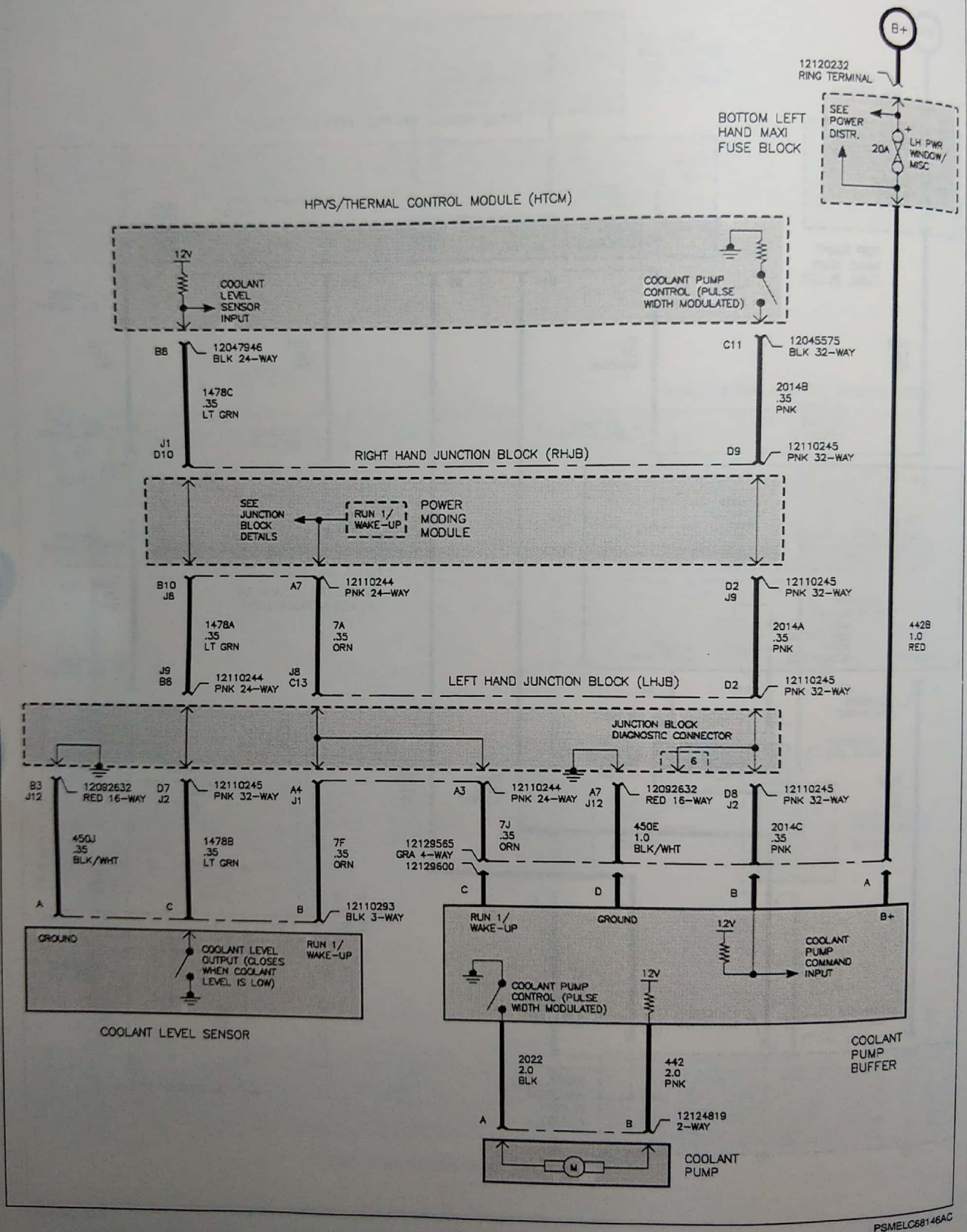
PSMELC68143AA



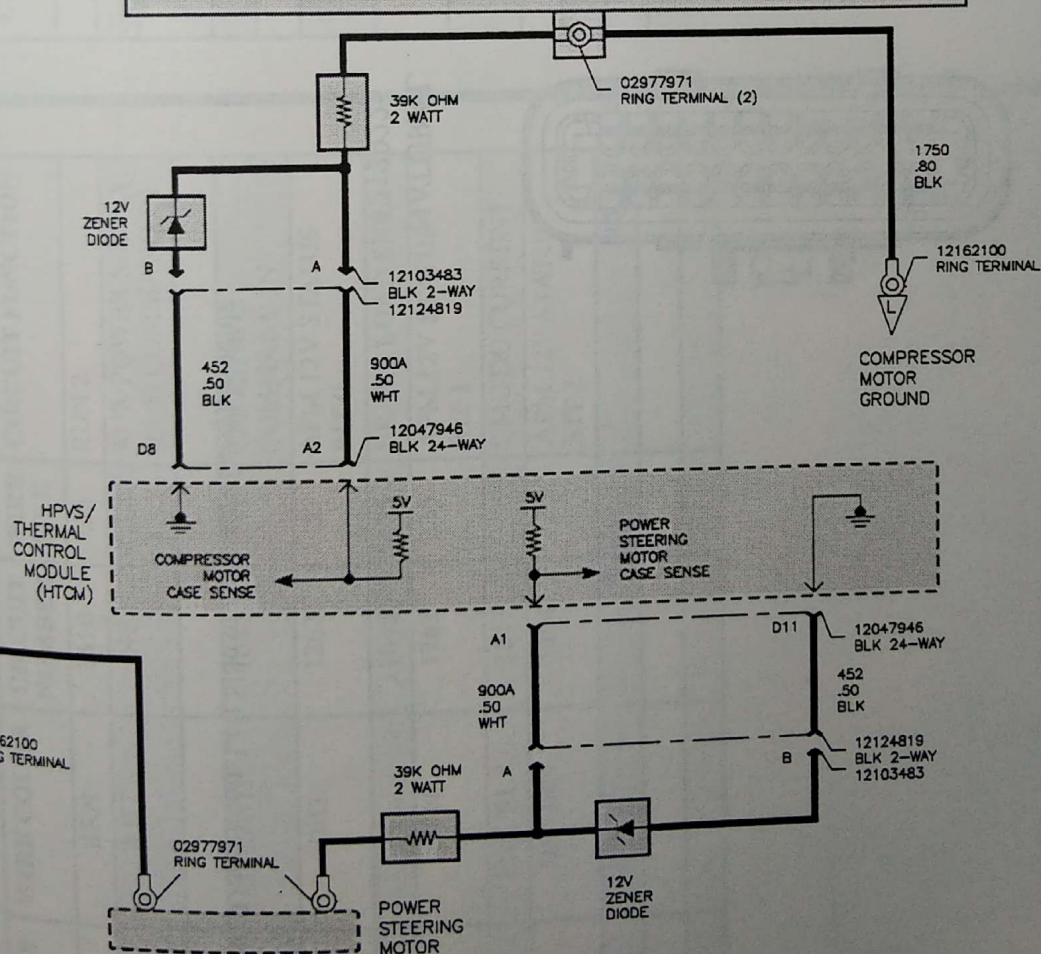
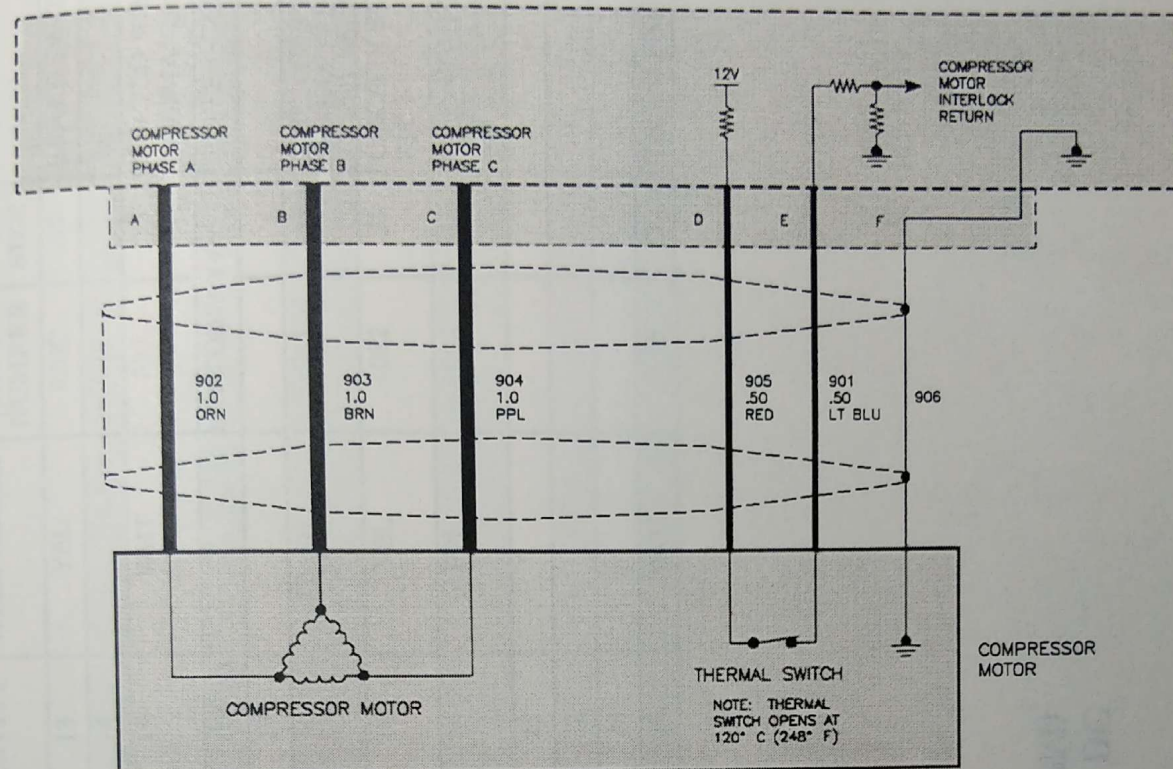
PSMELC68144AB



PSMELC68145AB



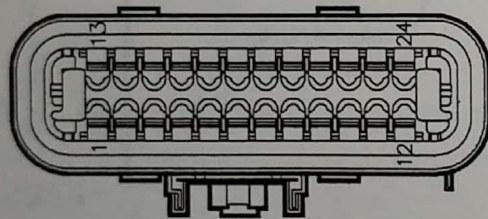
ACCESSORY AC AND DC POWER MODULE (APM)



PSMELC68147AB

HARNESS CONNECTOR FACES

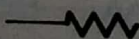
ACCESSORY AC AND DC POWER MODULE (APM)



NATURAL
12129225

Location: Underhood, Left Side of Accessory Power Module

PSMELC67235AA



HARNES CONNECTOR FACES

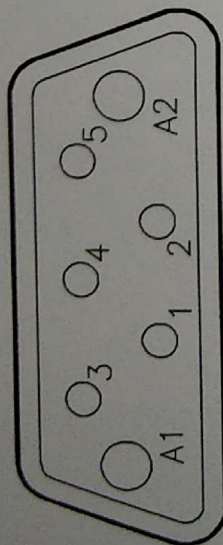
ACCESSORY AC AND DC POWER MODULE - 12129225

CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
1	BRN	241B	.35	RUN 2
2	WHT	249	.35	AUX POWER SUPPLY (APS) COMMAND IN
3				
4	BLK/WHT	1085	.35	CMC SPEED COMMAND IN
5	RED	1262	.35	APM 12V STATUS BIT 0
6	PPL	1645	.35	BRAKE LOAD SHED
7	ORN	1263	.35	APM 12V STATUS BIT 1
8	PNK/BLK	1217	.35	CMC DC CURRENT
9	DR GRN	1264	.35	APM 12V STATUS BIT 2
10				
11				
12				

CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
13	YEL	820C	.35	BRAKE SWITCH IN
14				
15	WHT	637	.35	HEATED W/S COMMAND IN
16				
17				
18	DK BLU	1081	.35	CMC/47V STATUS BIT 0
19	YEL	1082	.35	CMC/47V STATUS BIT 1
20	PPL	1083	.35	CMC/47V STATUS BIT 2
21				
22				
23				
24	WHT	2027C	.35	VEHICLE WAKE-UP

HARNESS CONNECTOR FACES

ACCESSORY POWER MODULE (APM)



BLINDMATE

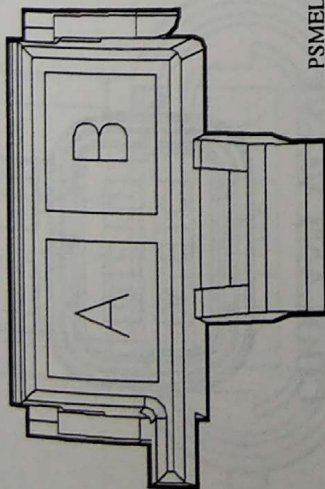
PSMELC68244AA

ACCESSORY POWER MODULE (APM)				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A1				HV BATT +
1				HV INTERLOCK RETURN -
2				
3				
4				
5				HV INTERLOCK +
A2				HV BATT -

Location: Underhood, Attached to Lower Left of Power Electronics Bay

HARNESS CONNECTOR FACES

BATTERY RECOVERY SWITCH (BRS)



PSMELC67223AA

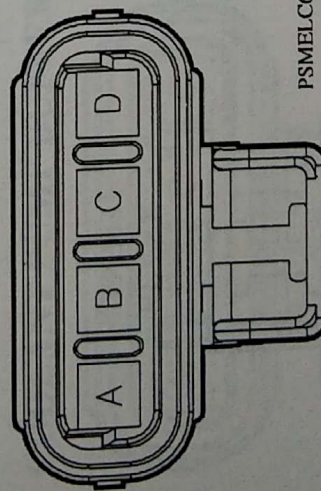
GRAY

12034341

BATTERY RECOVERY SWITCH - 12034341				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A	WHT	26C	.35	AD POWER SUPPLY
B	WHT	2027E	.35	VEHICLE WAKE-UP

Location: Passenger Compartment, Under Right Side of I/P

BLOWER MOTOR MODULE



PSMELC67176AA

DARK GREY

12129565

BLOWER MOTOR MODULE - 12129565				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A	BLK	350N	1.0	GROUND
B				
C	GRA/BLK	754	.35	BLOWER CONTROL IN
D	RED	1642	1.0	B+

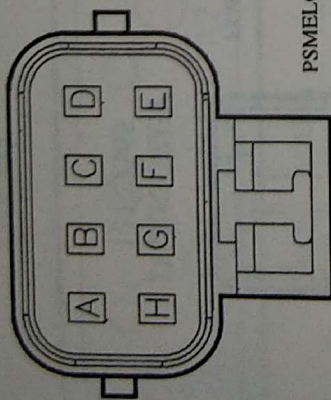
Location: Passenger Compartment, In Heat Pump Ventilation Module Under Right Side of I/P



HVAC 209

HARNESS CONNECTOR FACES

CHARGER RECEPTACLE



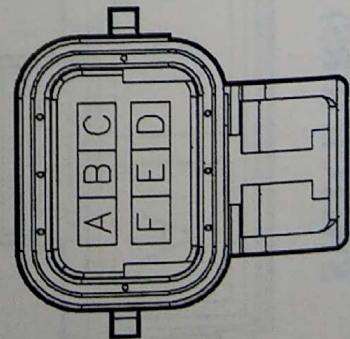
PSMELC67217AA

BLACK
12047937

CHARGER RECEPTACLE - 12047937				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A	ORN	2740	.35	CHARGER COUPLER PRESENT SWITCH B+
B	DK GRN	2023	.35	CHARGER COUPLER PRESENT SWITCH OUT
C	PPL	1807E	.35	CLASS 2 DATA
D	PNK	213C	.35	CHARGER RECEPTACLE TEMP SENSOR HI
E	BLK	450EE	.35	GROUND
F				
G	WHT	2027G	.35	VEHICLE WAKE-UP
H	BLK	450H	.35	GROUND

Location: Front of Vehicle, Near Charge Receptical

CHARGER RECEPTACLE COOLANT VALVE



PSMELC67215AA

BLACK
12052848

CHARGER RECEPTACLE COOLANT VALVE - 12052848				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A	ORN	7G	.35	RUN 1/WAKE-UP
B	TAN	134	.35	VALVE COMMAND IN
C	BLK/WHT	1704	.35	GROUND
D	GRA	605H	.35	+5V REF IN
E	BLK	212	.35	VALVE POSITION OUT
F				

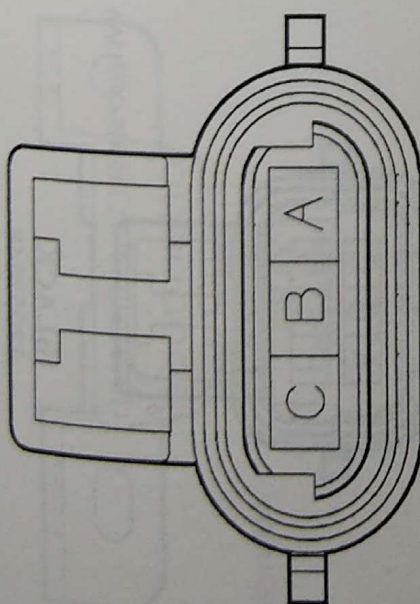
Location: Left Front, Attached to Midrail

HARNESS CONNECTOR FACES

COOLANT LEVEL SENSOR

COOLANT LEVEL SENSOR - 12110293				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A	BLK / WHT	450J	.35	GROUND
B	ORN	7F	.35	RUN I/WAKE-UP
C	LT GRN	1478B	.35	COOLANT LEVEL OUT

Location: Underhood, Below Coolant Expansion Tank



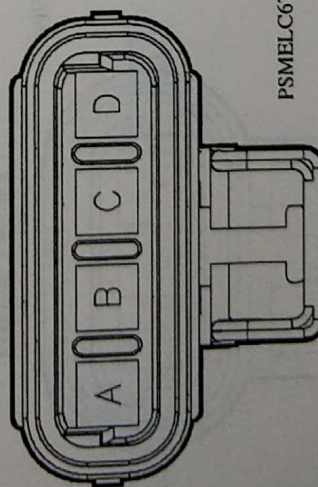
PSMELC66039AA

BLACK
12110293

COOLANT PUMP BUFFER

COOLANT PUMP BUFFER - 12129565				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A	RED	442B	1.0	B+
B	PNK	2014C	.35	COOLANT PUMP COMMAND IN
C	ORN	7J	.35	RUN I
D	BLK/WHT	450E	1.0	GROUND

Location: Left Front, Attached to Midrail

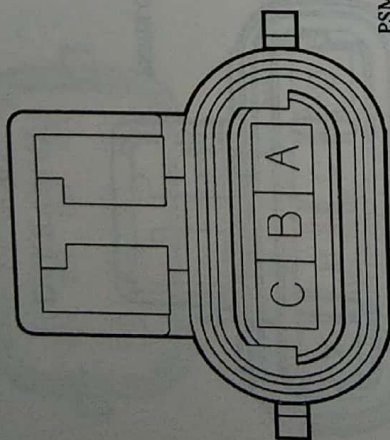


PSMELC67176AA

DARK GRAY
12129565

HARNESS CONNECTOR FACES

COOLANT PUMP TEMPERATURE SENSOR



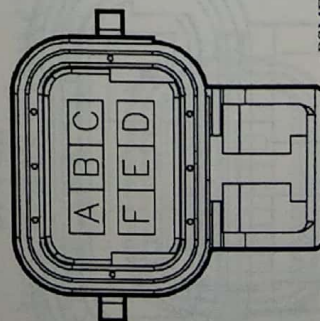
PSMELC66039AA

DARK GRAY
12129565

COOLANT PUMP TEMPERATURE SENSOR - 12129565				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A	BLK/WHIT	552H	.35	GROUND
B	YEL	410	.35	SENSOR HI

Location: Underhood, At Base of Coolant Pump

COOLANT RECOVERY CHECK VALVE



PSMELC67215AA

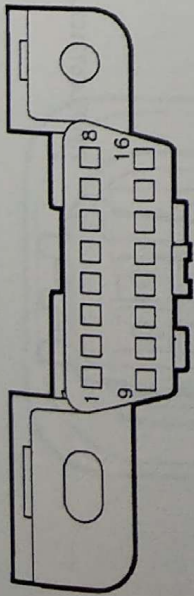
BLACK
12052848

COOLANT RECOVERY CHECK VALVE - 12052848				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A	ORN	7B	.35	RUN 1 / WAKE-UP
B	GRA/BLK	1596	.35	VALVE COMMAND IN
C	BLK	452E	.35	GROUND
D	LT BLU / BLK	605E	.35	+5V REF IN
E	PPL	2028	.35	VALVE POSITION OUT
F				

Location: Right Front Attached to Midrail

HARNESS CONNECTOR FACES

DATA LINK CONNECTOR (DLC)



PSMELC67259AA

GRAY

12110250

DATA LINK CONNECTOR - 12110250				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
1				
2	PPL	1807C	.35	CLASS 2 DATA
3				
4	BLK	450N	.35	GROUND
5	BLK	450T	.35	GROUND
6				
7				
8				
9	TAN	800L	.35	SERIAL DATA
10				
11				
12				
13				
14				
15				
16	ORN	1640	.35	B+

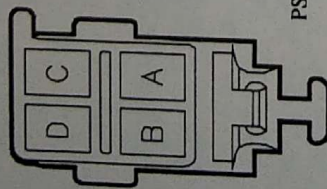
Location: Passenger Compartment, Under Lower Left of I/P



HVAC 213

HARNESS CONNECTOR FACES

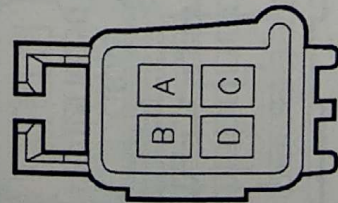
DEFOGGER AND BATTERY PACK FAN INLINE – FEMALE CONNECTOR



PSMELC67252AA

BLACK
12129136

DEFOGGER AND BATTERY PACK FAN INLINE – MALE CONNECTOR



PSMELC67210AA

BLACK
12129135

DEFOGGER AND BATTERY PACK FAN INLINE – 12129136				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A	RED	1242A	1.0	PRIMARY DEFOG B+
B	RED	1342A	1.0	SECONDARY DEFOG B+
C	RED	1142B	1.0	BATTERY PACK FAN MOTOR B+
D				

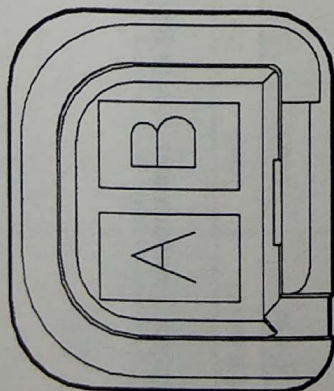
Location: Passenger Compartment, Right Side of I/P Above Junction Block

DEFOGGER AND BATTERY PACK FAN INLINE – 12129135				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A	RED	1242B	2.0	PRIMARY DEFOG B+
B	RED	1342B	3.0	SECONDARY DEFOG B+
C	RED	1142C	3.0	BATTERY PACK FAN MOTOR B+
D				

Location: Passenger Compartment, Right Side of I/P Above Junction Block

HARNESS CONNECTOR FACES

DISCHARGE TEMPERATURE SENSOR



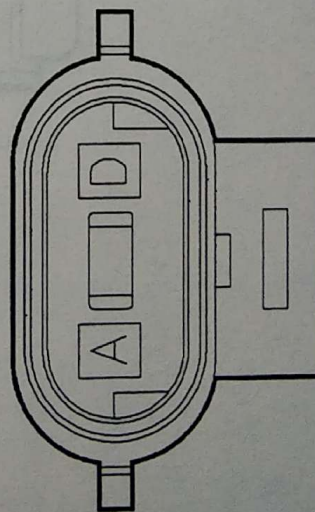
RED
12059252

PSMELC67240AA

DISCHARGE TEMPERATURE SENSOR - 12059252				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A	GRA	552E	.35	GROUND
B	DK GRN	734	.35	DISCHARGE TEMP SENSOR OUR

Location: Passenger Compartment, Inside HVAC Module

DRIVER DOOR JAMB SWITCH



BLACK
12110196

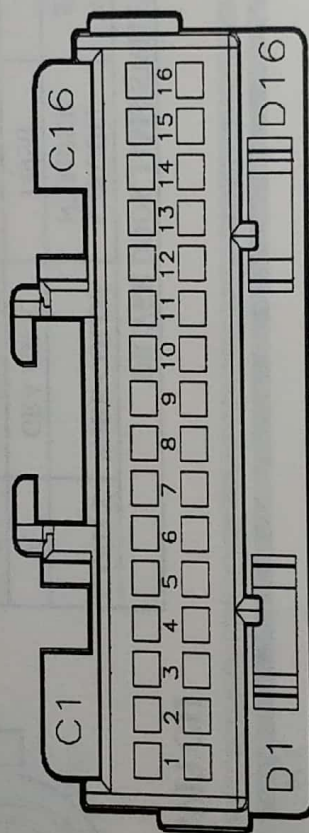
PSMELC67199AA

DRIVER DOOR JAMB SWITCH - 12110196				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A	GRA / BLK	1495B	.35	SWITCH HI
D	BLK	450L	.35	GROUND

Location: Driver Door, Part of Latch Assembly

HARNESS CONNECTOR FACES

HEAT PUMP VENTILATION SYSTEM/THERMAL CONTROL MODULE (HTCM)



BLACK
12045575

PSMELC67247AA

Location: Passenger Compartment, Lower Right Side of I/P

HARNES CONNECTOR FACES

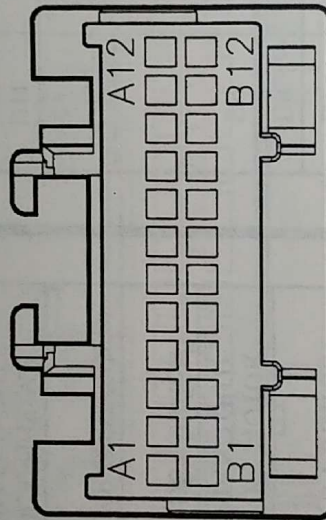
HEAT PUMP VENTILATION SYSTEM/THERMAL CONTROL MODULE - 12045575					
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION	
D1					
D2	RED	1262	.35	APM 12V STATUS BIT 0	
D3	DK GRN	1614	.35	OUTSIDE AIR VALVE COMMAND OUT	
D4	DK GRN	1264	.35	APM 12V STATUS BIT 2	
D5	WHT	193C	.35	REAR DEFOGGER COMMAND OUT	
D6	TAN	800H	.35	SERIAL DATA	
D7					
D8					
D9	GRA/BLK	1596	.35	COOLANT RECOVERY CHECK VALVE COMMAND OUT	
D10	BRN/WHT	1218	.35	MODE DOOR COMMAND OUT	
D11					
D12					
D13					
D14	BLK	452B	.35	MODE DOOR GROUND	
D15	WHT	2027B	.35	WAKE-UP IN	
D16	BLK / WHT	350H	.35	HTCM GROUND	

CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
C1	WHT	637	.35	HEATED W/S COMMAND
C2	DK BLU	1081	.35	CMC/47V STATUS BIT 0
C3	BLK/WHT	1085	.35	CMC SPEED OUT
C4	ORN	1063	.35	APM 12V STATUS BIT 1
C5	YEL	1082	.35	CMC/47V STATUS BIT 1
C6				
C7	PPL	1083	.35	CMC/47V STATUS BIT 2
C8	GRA/BLK	754	.35	BLOWER MOTOR COMMAND OUT
C9	PNK/BLK	1217	.35	CMC DC CURRENT IN
C10	PPL	1645	.35	BRAKE LOAD SHED IN
C11	RED	2014B	.35	COOLANT PUMP COMMAND OUT
C12				
C13	DK GRN	335	.35	COOLING FAN COMMAND OUT
C14	ORN	840R	.35	REVERSING VALVE B+
C15	BLK	452C	.35	OUTSIDE AIR VALVE GROUND
C16	WHT	2016	.35	REVERSING VALVE HI OUT



HARNESS CONNECTOR FACES

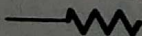
HEAT PUMP VENTILATION SYSTEM/THERMAL CONTROL MODULE (HTCM)



PSMELC67250AA

BLACK
12047946

Location: Passenger Compartment, Lower Right Side of I/P



HARNESS CONNECTOR FACES

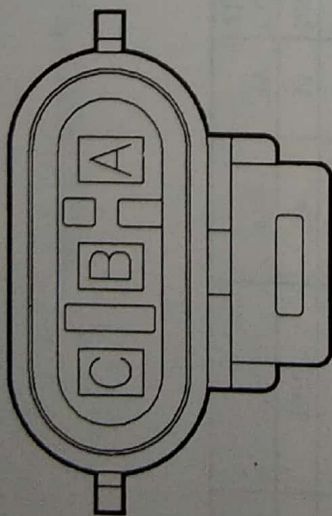
HEAT PUMP VENTILATION SYSTEM THERMAL CONTROL MODULE - 12047946

CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A1	WHT	900A	.50	EHPS GRD SENSE
A2	WHT	900A	.50	COMP GRD SENSE
A3	PPL	1838	.35	OUTSIDE AIR VALVE IN
A4	PPL	2028	.35	3-WAY COOLANT VALVE IN
A5	BLK	212	.35	CHARGER RECEPTACLE COOLANT VALVE IN
A6	RED/BLK	380	.35	LOW SIDE REFRIG PRESSURE IN
A7	LT GRN/BLK	735	.35	OUTSIDE AIR TEMP IN
A8	LT GRN	2032	.35	DRIVE MOTOR COOLANT TEMP IN
A9	DK GRN	734	.35	DISCHARGE TEMP SENSOR IN
A10	YEL	1644	.35	HIGH SIDE REFRIG PRESSURE IN
A11	RED	708	.35	MODE VALVE IN
A12	YEL	410	.35	COOLANT PUMP TEMP IN

CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
B1	GRA	605A	.35	+5V REF SIGNAL
B2	ORN	840L	.35	HTCM B+
B3				
B4				
B5				
B6	BRN	41N	.35	HTCM RUN 1
B7				
B8	LT GRN	1478C	.35	COOLANT LEVEL IN
B9	BLK/WHT	1704	.35	CHARGER RECEPTACLE COOLANT VALVE GROUND
B10	TAN	134	.35	CHARGER RECEPTACLE COOLANT VALVE COMMAND
B11	BLK	452E	.35	COOLANT RECOVERY CHECK VALVE GROUND
B12	DK BLU	732	.35	REFRIG TEMP IN

HARNESS CONNECTOR FACES

HIGH NOTE HORN



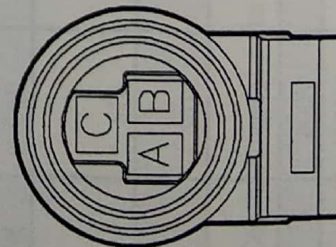
PSMELC67234AA

BLACK
12059595

HIGH NOTE HORN - 12059595				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A	ORN	40	.35	B+
B	PPL	2025B	.35	HORN COMMAND IN
C	BLK	350A	.35	GROUND

Location: Right Side, Above Wheel House Panel Liner

HIGH PRESSURE SENSOR



PSMELC67231AA

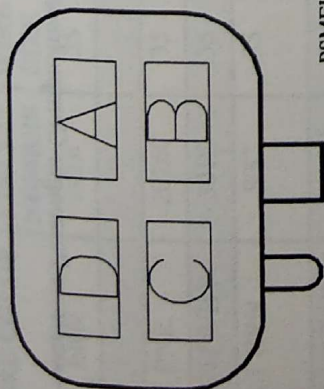
BLACK
12110192

HIGH PRESSURE SENSOR - 12110192				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A	BLK	552B	.35	GROUND
B	LT BLU / BLK	605F	.35	+5V REF
C	RED / BLK	380	.35	HIGH SIDE PRESSURE OUT

Location: Underhood, Left Side Attached to Refrigerant Line

HARNESS CONNECTOR FACES

INSIDE REARVIEW MIRROR



PSMELC67229AA

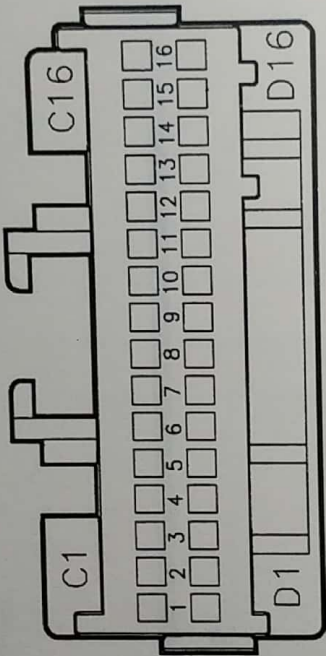
BLACK
12047785

INSIDE REARVIEW MIRROR - 12047785				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A	WHT	156C	.35	LAMPS LO
B	BLK	350M	.35	LAMPS GROUND
C	ORN	1732F	.35	LAMPS HI
D				

Location: Passenger Compartment, Behind Rearview Mirror

HARNESS CONNECTOR FACES

INSTRUMENT PANEL CLUSTER (IPC)



PSMELC67184AA

LIGHT BLUE
12110207

Location: Passenger Compartment, Center of I/P

HARNESS CONNECTOR FACES

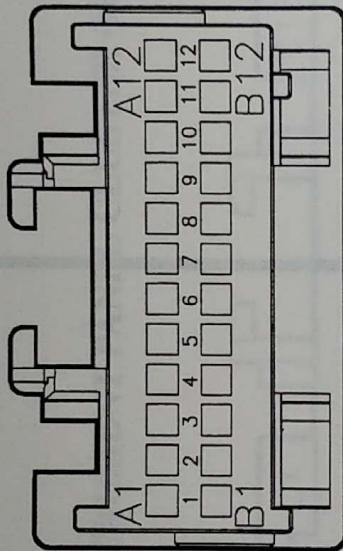
INSTRUMENT PANEL CLUSTER - 12110207

CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
C1	BRN	41B	.35	RUN I
C2				
C3	PNK	2026C	.35	LOW HORN OUT
C4	BRN / WHT	301C	.35	PARK LAMPS ON IN
C5	LT GRN	80C	.35	VEHICLE IN RUN/ACC IN
C6	YEL / BLK	1334C	.35	LR TURN IN
C7	LT BLU	1059	.35	PWR STRG HAND WHEEL SENSOR IN
C8	DK GRN/WHT	1335C	.35	RR TURN IN

C9	WHT	1765	.35	STEERING PUMP SPEED OUT
C10	ORN/BLK	556	.35	PWR STRG HAND WHEEL SENSOR GROUND
C11	PPL	2025C	.35	HI HORN OUT
C12	BRN / WHT	230E	.35	DIM LEVEL IN
C13				
C14	BLK / WHT	450S	.35	GROUND
C15	GRA	1056	.35	PWR STRG HAND WHEEL SENSOR +5V REF
C16	DK BLU	1495F	.35	DOOR AJAR IN

HARNESS CONNECTOR FACES

LEFT HAND JUNCTION BLOCK (LHJB) (J1)



PSMELC67180AA

PINK
12110244

Location: Passenger Compartment Left, Under Left Side of I/P



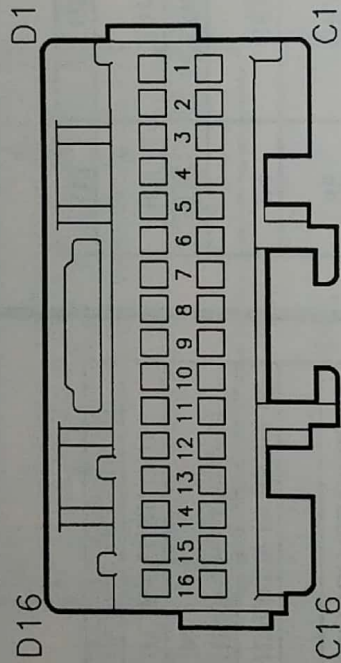
HARNES CONNECTOR FACES

LEFT HAND JUNCTION BLOCK - J1 - 12110244

CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION	CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A1	DK BLU	1495F	.35	IPC DOOR AJAR	B1				
A2	WHT	2027G	.35	CHARGE RECEPTACLE WAKE-UP	B2				
A3	ORN	7J	.35	CLNT PUMP BUFFER RUN 1 WAKE-UP	B3	BLK	407E	.35	RF BRAKE PRESSURE SENSOR GROUND
A4	ORN	7F	.35	CLNT LEVEL SENSOR RUN 1/WAKE-UP	B4	BLK	407C	.35	LF BRAKE PRESSURE SENSOR GROUND
A5	ORN	640H	.35	TURN SIGNAL SWITCH	B5	BLK	407B	.35	MC1 PRESSURE SENSOR GROUND
A6	ORN	640B	.35	HEADLAMP SWITCH B+	B6	GRA	416F	.35	MC2 PRESSURE SENSOR +5V
A7	ORN	640C	.35	RR LICENSE LAMP HI	B7	GRA	416E	.35	RF PRESSURE SENSOR +5V
A8					B8	GRA	416B	.35	MC1 PRESSURE SENSOR +5V
A9	PPL	524B	.35	HDLP SW HI BEAM IN	B9	GRA	416H	.35	LF PRESSURE SENSOR +5V
A10	YEL	525B	.35	HDLP SW LO BEAM IN	B10	BLK/WHT	238B	.35	IPC LH SEAT BELT
A11	DK GRN/WHT	1335C	.35	IPC RR TURN OUT	B11	TAN	1885B	.35	SERVICE SOON TT PASS THRU
A12	BRN/WHT	301C	.35	IPC PARK LAMPS ON	B12	LT GRN	2030B	.35	IPC TEMP TT

HARNESS CONNECTOR FACES

LEFT HAND JUNCTION BLOCK (J2)



PSMELC67251AA

PINK

12110245

Location: Passenger Compartment, Under Left Side of I/P



HARNESS CONNECTOR FACES

LEFT HAND JUNCTION BLOCK - J2 - 12110245

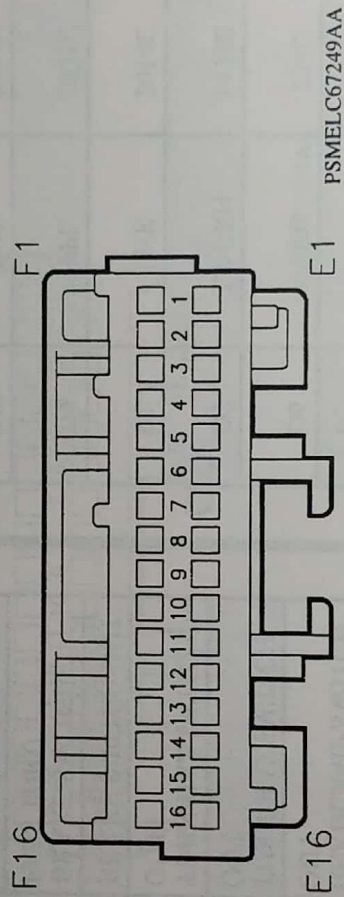
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
C1	YEL/BLK	1334C	.35	IPC LR TURN OUT
C2	LT BLU	14	.50	LF TURN LAMP HI
C3	PNK	228C	1.0	WASHER PUMP HI
C4	WHT	17	1.0	BRAKE SWITCH IN
C5	BRN/WHT	230E	.35	IPC DIM LEVEL
C6	ORN	2740	.35	CHARGER RECEPTACLE B+
C7	LT BLU	74	1.0	HEADLAMP SWITCH OUT
C8	LT BLU/WHT	1414	.35	TURN/HAZ SWITCH OUT
C9	DK BLU/WHT	1415	.35	TURN/HAZ SWITCH OUT
C10	BRN	86B	.80	BRAKE SWITCH OUT
C11	BRN	86C	.35	BRAKE SWITCH PASS THRU
C12	BRN	41C	.35	PCM RUN 1
C13	BRN	41B	.35	IPC RUN 1
C14	BRN	41G	.35	TURN/HAZ SWITCH RUN 1
C15	BRN	41P	.35	CRUISE SWITCH RUN 1
C16	BRN	41R	.80	BRAKE SWITCH RUN 1

CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
D1	BRN/WHT	419B	.35	IPC SERVICE NOW INDICATOR
D2	RED	1084	.35	IPC CHECK TIRE PRESSURE INDICATOR
D3	WHT/BLK	2029	.35	IPC WAIT INDICATOR
D4	WHT	2019	.35	IPC BATT DAMAGE INDICATOR
D5				
D6	YEL	234C	.35	IPC SEAT BELT INDICATOR
D7	LT GRN	1478B	.35	COOLANT LEVEL SENSOR
D8	PNK	2014C	.35	COOLANT PUMP BUFFER
D9	PPL	2025C	.35	HIGH NOTE HORN COMMAND IN
D10	PNK	2026C	.35	LOW NOTE HORN COMMAND IN
D11				
D12	PPL	1807E	.35	CHARGER RECEPTACLE CLASS 2 DATA
D13	PNK	213C	.35	CHARGER RECEPTACLE TEMP
D14	RED	2018B	.35	IPC REDUCED PERF INDICATOR
D15	TAN/WHT	816B	.35	PCM BTSI PASS THRU
D16	BLK	28	.35	HORN COMMAND



HARNESS CONNECTOR FACES

LEFT HAND JUNCTION BLOCK (J6)



TAN

12110112

Location: Passenger Compartment, Under Left Side of I/P

HARNESS CONNECTOR FACES

LEFT HAND JUNCTION BLOCK - J6 - 121H0112

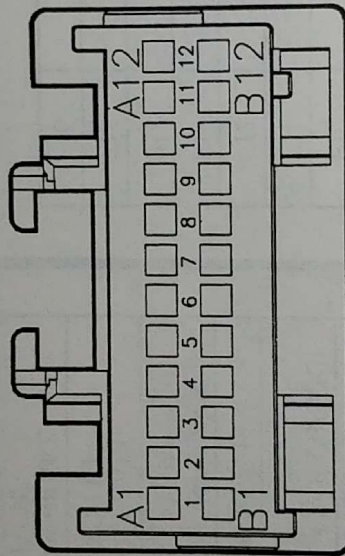
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
E1	ORN	2540	.35	BTCM B+
E2	BLK	2015	.35	BTCM POWER MOD IN
E3	BLK	151	.35	PARK BRAKE SWITCH
E4	PNK	1632	.35	BTCM POWER MOD IN
E5	TAN/WHT	33	.35	BTCM BRAKE IND
E6	BLK	407A	.35	BTCM GROUND
E7	DK BLU	1660B	.35	BTCM LOW TRAC IND
E8	DK BLU/WHT	1934	.35	BTCM PARK BRAKE IND
E9	BRN	41E	.35	BTCM RUN I
E10	WHT	852B	.35	BTCM ANTILOCK INDICATOR
E11	ORN	640F	.35	PARK BRAKE SWITCH B+
E12	BRN/WHT	230F	.35	PARK BRAKE SWITCH
E13	BLK	450Y	.35	PARK BRAKE SWITCH GROUND
E14	BLK	450N	.35	DLC GROUND
E15	BLK	450T	.35	DLC GROUND
E16	BLK	1640	.35	DLC B+

CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
F1	PPL	1807C	.35	DLC CLASS 2 DATA
F2				
F3	TAN	800L	.35	DLC SERIAL DATA
F4	TAN	800E	.35	BTCM SERIAL DATA
F5	BLK	884B	.35	BTCM LR WSS HI
F6	BRN	882B	.35	BTCM RR WSS HI
F7	WHT	883B	.35	BTCM RR WSS LO
F8	RED	885B	.35	BTCM LR WSS LO
F9	GRA	416A	.35	BTCM +5V REF
F10				
F11				
F12				
F13				
F14				
F15				
F16				



HARNESS CONNECTOR FACES

LEFT HAND JUNCTION BLOCK (J9)



PSMELC67180AA

PINK

12110244

Location: Passenger Compartment, Under Left Side of I/P



HARNESS CONNECTOR FACES

LEFT HAND JUNCTION BLOCK - J9 - 12110244

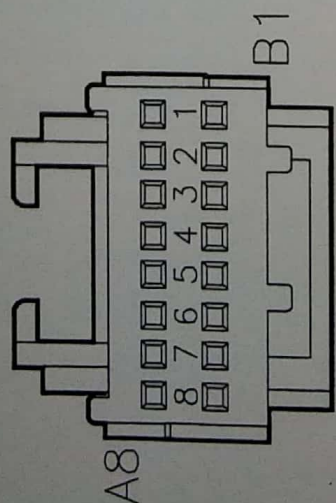
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A1	BRN	9A	.35	REAR LICENSE LAMPS HI REAR SIDE MARKER LAMPS HI REAR TAIL/STOP LAMPS HI
A2	YEL/BLK	1334A	.35	LR TURN LAMP HI
A3	LT GRN	1966A	.35	TO RH TURN/HAZ/DRL MODULE
A4	DK GRN/WHT	1335A	.35	TO RH TURN/HAZ/DRL MODULE

A5	LT BLU	20A	.80	STOP LAMPS HI
A6	BRN	41A	.35	FROM POWER MODING MODULE RUN 1
A7	YEL	820A	.35	CENTER HIGH MOUNTED STOP LAMP HI
A8	BRN/WHT	301B	.35	HEADLAMP SW TO RADIO
A9	BRN/WHT	301E	.35	HEADLAMP SW TO RSA
A10	RED	228A	.35	WASHER PUMP HI
A11	ORN	240	.35	RSA B+
A12	BRN/WHT	309A	.35	RF PARK LAMPS HI



HARNESS CONNECTOR FACES

LEFT HAND JUNCTION BLOCK (LHJB) (J12)



PSMELC67179AA

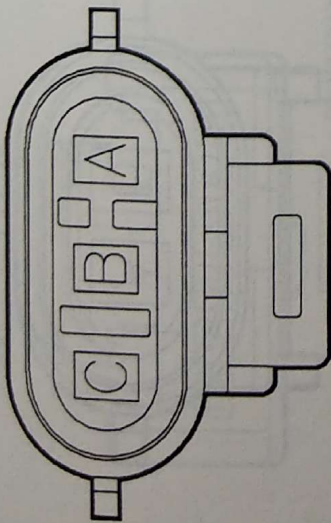
RED
12092632

LEFT HAND JUNCTION BLOCK - J12 - 12092632				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A1	BLK	450S	.35	DSCM GROUND
A2	BLK	450C	.50	LF PARK/TURN LAMP GROUND
A3	BLK	450G	.35	LF MARKER LAMP GROUND
A4	BLK	450P	.35	PSCM GROUND
A5	BLK	450R	.35	PCM GROUND
A6	BLK	106	.35	OIL PUMP LO
A7	BLK	450E	1.0	COOLANT PUMP BUFFER GROUND
A8	BLK	450EE	.35	CHARGE PORT GROUND
B1				
B2	BLK	450H	.35	CHARGE PORT GROUND
B3	BLK	450J	.35	COOLANT LEVEL SENSOR GROUND
B4				
B5				
B6				
B7				
B8				

Location: Passenger Compartment, Under Left Side of I/P

HARNESS CONNECTOR FACES

LOW NOTE HORN



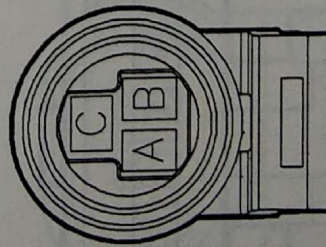
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BLACK
12059595

LOW NOTE HORN - 12059595				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A	ORN	140	.35	B+
B	PNK	2026B	.35	HORN COMMAND IN
C	BLK / WHT	350B	.35	GROUND

Location: Right Side, Above Wheel House Panel Liner

LOW PRESSURE SENSOR



PSMELC67231AA

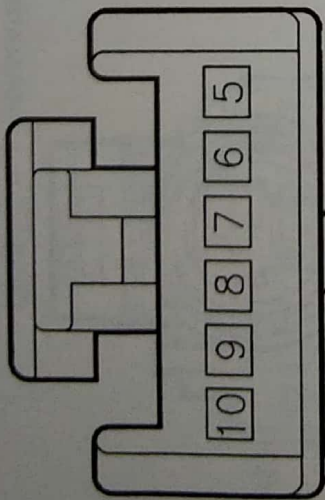
BLACK
12110192

LOW PRESSURE SENSOR - 12110192				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A	BLK	552C	.35	GROUND
B	GRA	605G	.35	+5V REF
C	YEL	1644	.35	LOW SIDE PRESSURE OUT

Location: Underhood, Center Attached to Refrigerant Line

HARNESS CONNECTOR FACES

MODE VALVE ACTUATOR



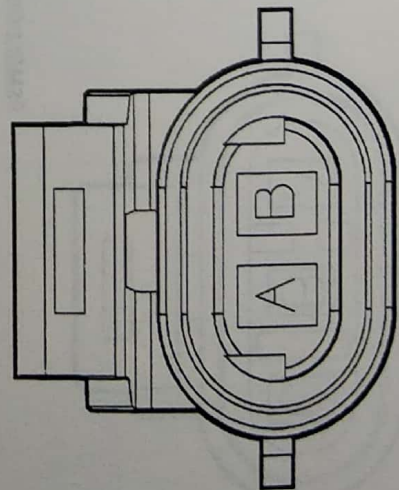
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BLACK
12064993

MODE VALVE ACTUATOR - 12064993				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
5	ORN	7C	.35	RUN I/WAKE-UP
6	BRN/WHT	1218	.35	VALVE COMMAND IN
7	BLK	452B	.35	GROUND
8				
9	RED	708	.35	VALVE POSITION OUT
10	LT BLU/BLK	605B	.35	+5V REF IN

Location: Passenger Compartment, Under Right Side of I/P

MOTOR WINDING TEMPERATURE SENSOR



PSMELC66031AA

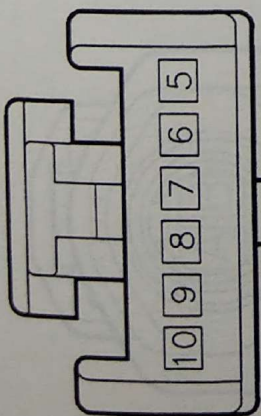
GRAY
12052644

MOTOR WINDING TEMPERATURE SENSOR - 12052644				
CAVITY	WIRE COLOR	CIRCUIT NO.	WIRE SIZE	CIRCUIT FUNCTION
A	LT GRN	37	.50	SENSOR HI
B	GRA/BLK	1798	.50	GROUND

Location: Underhood, Top Center of Drive Motor

HARNES CONNECTOR FACES

OUTSIDE AIR VALVE ACTUATOR



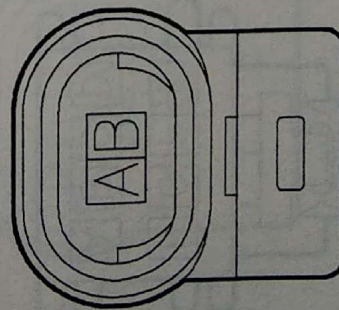
PSMELC68246AA

BLACK
12064993

OUTSIDE AIR VALVE ACTUATOR - 12064993				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
5	ORN	7E	.35	RUN 1/WAKE-UP
6	DK GRN	1614	.35	DOOR COMMAND IN
7	BLK	452C	.35	GROUND
8				
9	PPL	1838	.35	DOOR POSITION OUT
10	GRA	605C	.35	+5V REF IN

Location: Passenger Compartment, Under Right Side of I/P

OUTSIDE TEMPERATURE SENSOR



PSMELC68247AA

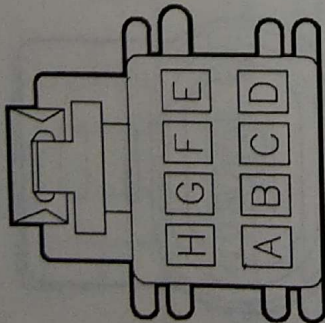
BLACK
12110170

OUTSIDE TEMPERATURE SENSOR - 12110170			
CAVITY	WIRE COLOR	CIRCUIT NUMBER	CIRCUIT FUNCTION
A	LT GRN / BLK	735	SENSOR HI
B	BLK	552F	GROUND

Location: Underbody, Behind Front Fascia

HARNESS CONNECTOR FACES

PARK BRAKE SWITCH



BLUE
12064766

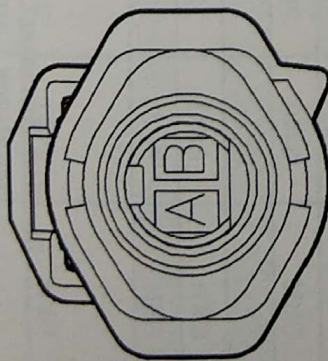
PSMELC67230AA

Location: I/P Lower Left

PARK BRAKE SWITCH - 12064766				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A	BLK	450Y	.35	GROUND
B			.35	
C	LT BLU	1134	.35	PARK BRAKE SWITCH IDLE OUT
D	ORN	640F	.35	B+
E	BLK/WHT	151	.35	GROUND
F	PNK	2031	.35	PARK BRAKE SWITCH WAKE-UP OUT
G				
H	BRN/WHT	230F	.35	DIMMER IN

HARNES CONNECTOR FACES

REFRIGERANT TEMPERATURE SENSOR



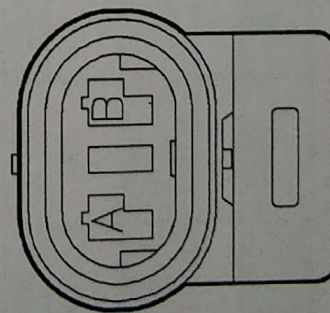
BLACK
12092512

PSMELC67245AA

REFRIGERANT TEMPERATURE SENSOR - 12092512				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A	DK BLU	732	.35	SENSOR HI
B	GRA	552G	.35	GROUND

Location: Underhood, Left Side Attached to Refrigerant Line

REVERSING VALVE



GRAY
12162343

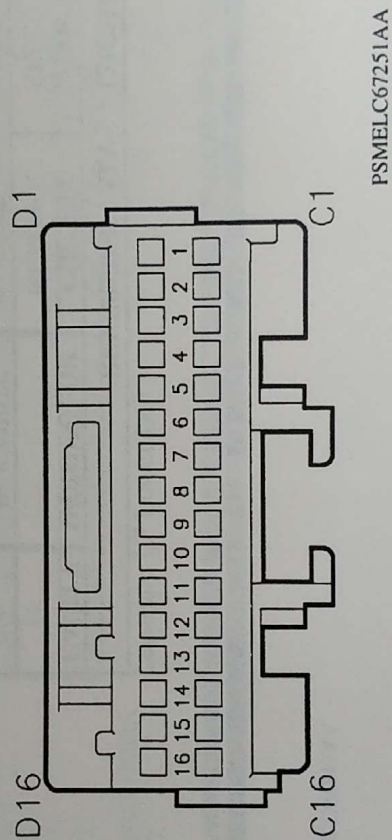
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REVERSING VALVE - 12162343				
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A	BLK / WHT	350R	.35	GROUND
B	WHT	2016	.35	VALVE HI

Location: Underhood, Center of Crossmember

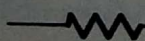
HARNESS CONNECTOR FACES

RIGHT HAND JUNCTION BLOCK (J1)



PINK
12110245

Location: Passenger Compartment, Under Right Side of I/P



HARNESS CONNECTOR FACES

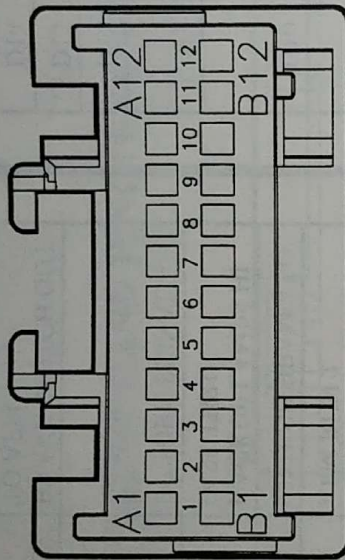
RIGHT HAND JUNCTION BLOCK - J1 - 12110245

CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
D1				
D2	PNK	213B	.35	CHARGE PORT TEMP TO BPM
D3				
D4	LT GRN	275E	.35	PRND ENCODER IN
D5	LT GRN	275B	.35	PRND ENCODER TO BPM
D6	PPL	1807B	.35	BPM CLASS 2 DATA
D7	WHT	108B	.35	BATTERY PACK FAN PASS THRU
D8	BLK/WHT	238E	.35	LH SEAT BELT SWITCH TO SDM PASS THRU
D9	PNK	2014B	.35	COOLANT PUMP TO HTCM PASS THRU
D10	LT GRN	1478C	.35	COOLANT LEVEL SENSOR TO HTCM PASS THRU
D11	WHT	193C	.35	HTCM TO TJB PASS THRU
D12				
D13				
D14				
D15	BRN	358E	.35	AIR BAG INDICATOR TO SDM
D14				

CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
C1	ORN	840R	.35	TO HTCM - REVERSING VALVE B+
C2	ORN	840L	.35	HTCM B+
C3	ORN	840B	.35	BPM B+
C4				
C5	ORN	2840	.80	PRND ENCODER B+
C6	RED	228B	.35	WASHER PUMP HI PASS THRU
C7	BRN	41S	.35	BPM RUN 1
C8	BRN	41N	.35	HTCM RUN 1
C9				
C10	YEL	1139	.50	SDM RUN 1
C11	BRN	241B	.35	APM RUN 2
C12	LT GRN	1193B	.50	RH HIGH BEAM - LO
C13	LT GRN	24A	.50	BACKUP LAMPS HI PASS THRU
C14	DK BLU	15	.50	RF TURN SIGNAL - HI
C15				
C16	YEL	820C	.35	BRAKE SWITCH OUT TO APM

HARNESS CONNECTOR FACES

RIGHT HAND JUNCTION BLOCK (RHJB) (J2)



PSMELC67180AA

PINK
12110244

Location: Passenger Compartment Under Right Side of I/P



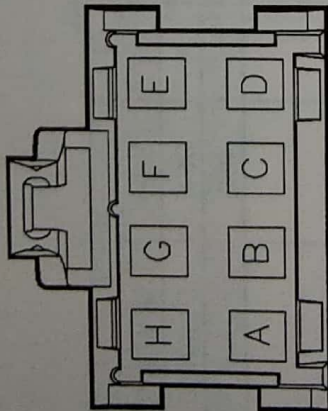
HARNES CONNECTOR FACES

RIGHT HAND JUNCTION BLOCK - J2 - 12110244

CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION	CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
A1	DK BLU	1191B	.50	RH LOW BEAM - LO	B1				
A2	ORN	40	.35	LOW NOTE HORN B+	B2	WHT	2027B	.35	HTCM WAKE-UP IN
A3	ORN	140	.35	HIGH NOTE HORN B+	B3	WHT	2027F	.35	BPM WAKE-UP IN
A4	ORN	7K	.35	BPM RUN 1/ WAKE-UP	B4	WHT	2027C	.35	APM WAKE-UP IN
A5	ORN	7B	.35	COOLANT RECOVERY CHECK VALVE RUN 1/ WAKE-UP	B5				
A6	ORN	7C	.35	MODE VALVE RUN 1/ WAKE-UP	B6	PPL	2025B	.35	LOW NOTE HORN PASS THRU
A7	ORN	7E	.35	OUTSIDE AIR VALVE RUN 1/ WAKE-UP	B7	PNK	2026B	.35	HIGH NOTE HORN PASS THRU
A8	ORN	7H	.35	COOLING FAN BUFFER RUN 1/ WAKE-UP	B8				
A9	ORN	7G	.35	CHARGER RECEPTACLE COOLANT VALVE RUN 1/ WAKE-UP	B9				
A10	WHT	26B	.35	BPM WAKE-UP	B10	TAN	800H	.35	HTCM SERIAL DATA
A11	BRN/WHT	309C	.35	RF PARK LAMP - HI	B11	TAN	800G	.35	BPM SERIAL DATA
A12	BRN/WHT	309B	.50	RF MARKER LAMP - HI	B12	TAN	800K	.35	SDM SERIAL DATA

HARNESS CONNECTOR FACES

RIGHT HAND JUNCTION BLOCK (RHJB) (J5)



PSMELC67248AA

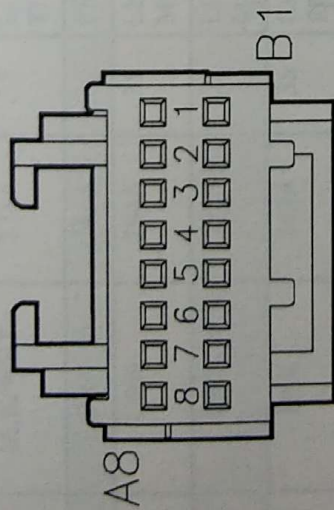
GRAY
12110626

RIGHT HAND JUNCTION BLOCK - J5 - 12110626				
CAVITY	WIRE COLOR	CIRCUIT NO.	WIRE-SIZE	CIRCUIT FUNCTION
A	BLK	350F	1.0	FRONT END COOLING FAN BUFFER GROUND
B	RED	842	1.0	HAZ/RUN/ACC/MISC FUSE B+
C	RED	1442B	1.0	R HDLP LO FUSE B+
D				
E	BLK	350N	1.0	BLOWER MOTOR GROUND
F				
G	BLK	227C	1.0	WIPER MOTOR LO
H	DK BLU	227E	.35	WASHER PUMP LO

Location: Passenger Compartment, Under Right Side of I/P

HARNESS CONNECTOR FACES

**RIGHT HAND
JUNCTION BLOCK
(RHJB)
(J6)**



PSMELC67179AA

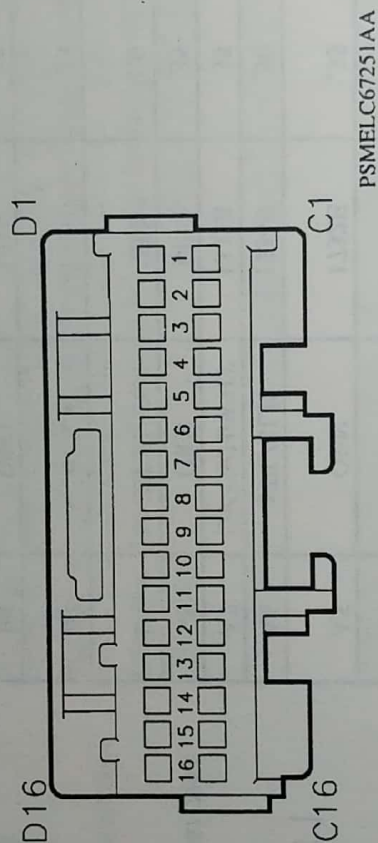
RED
12092632

RIGHT HAND JUNCTION BLOCK - J6 - 12092632			
CAVITY	WIRE COLOR	CIRCUIT NO.	WIRE-SIZE
A1	BRN	9B	.35
			REAR LICENSE LAMPS HI REAR SIDE MARKER LAMPS HI REAR TAIL/STOP LAMPS HI
A2	BRN	41F	.35
			DEFOGGER MODULE RUN 1
A3	ORN	1732G	.35
			FOUR BAR LAMP HI
A4	ORN	1732F	.35
			INSIDE REAR VIEW MIRROR
A5	ORN	1732E	.35
			CARGO LAMP SWITCH HI
A6	YEL/BLK	1334B	.50
			LR TURN LAMP HI
A7	DK GRN/WHT	1335B	.35
			RR TURN LAMP HI
A8	ORN	1440	.35
			POWER OUTLET B+
B1	LT BLU	20B	1.0
			STOP LAMPS B+ PASS THRU
B2	BLK	350M	.35
			INSIDE REAR VIEW MIRROR GROUND
B3	WHT	193B	.35
			REAR DEFOGGER COMMAND - DEFOGGER MODULE
B4	YEL	820B	.50
			CENTER HIGH MOUNTED STOP LAMP - HI
B5	WHT	108C	.35
			BATT PACK FAN PASS THRU
B6	LT BLU	156B	.35
			FOUR BAR LAMP LO
B7	WHT	156	.35
			INSIDE REAR VIEW MIRROR LO
B8	LT GRN	24B	1.0
			BACKUP LAMPS HI PASS THRU

Location: Passenger COmpartment, Under Right Side of I/P

HARNESS CONNECTOR FACES

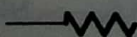
RIGHT HAND JUNCTION BLOCK (J9)



PINK

12110245

Location: Passenger Compartment, Under Right Side of I/P



HARNESS CONNECTOR FACES

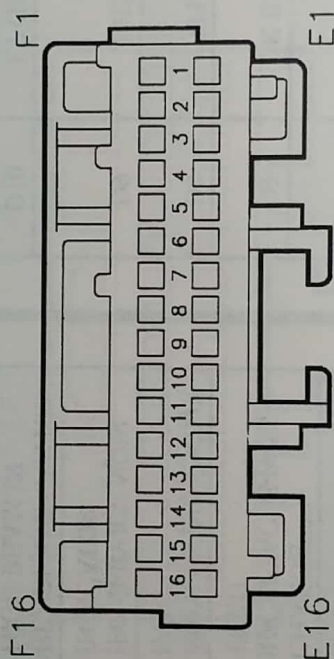
RIGHT HAND JUNCTION BLOCK - J9 - 12110245

CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
D1	WHT	2027E	.35	BATTERY RECOVERY SWITCH WAKE-UP
D2	RED	2014A	.35	COOLANT PUMP BUFFER PASS THRU
D3	YEL	234A	.35	IPC SEAT BELT INDICATOR
D4	TAN	800J	.35	IPC SERIAL DATA
D5	PPL/WHT	889A	.35	RH HORIZONTAL MIRROR MOTOR
D6	BRN/WHT	1498A	.35	RH MIRROR MOTOR HI
D7	DK BLU	1660A	.35	BTCM LOW TRAC INDICATOR
D8	PPL	1885A	.35	PCM SERVICE SOON INDICATOR
D9	RED	2018A	.35	IPC REDUCED PERFORMANCE INDICATOR
D10	LT GRN	2030A	.35	IPC TEMP IND
D11	PNK	2026A	.35	HIGH NOTE HORN PASS THRU
D12	PPL	2025A	.35	LOW NOTE HORN PASS THRU
D13	RED/WHT	881A	.35	RH VERT MIRROR MOTOR
D14	LT GRN	838A	.35	TURN/HAZ/DRL MOD
D15	PPL	1807A	.35	BPM CLASS 2
D16	ORN/BLK	781A	.35	RF LH DOOR LOCK SWITCH - UNLOCK

CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
C1	DK BLU/WHT	1495A	.35	DOOR JAMB SWITCH HI
C2	TAN	167	.35	RSA RH WINDOW DOWN
C3	BLK/WHT	238A	.35	LH SEAT BELT PASS THRU
C4	BRN	241A	.35	PSCM RUN 2
C5	ORN	294A	.35	LH DOOR LOCK MOTOR
C6	GRA	295A	.35	LH DOOR LOCK MOTOR
C7	PNK	213A	.35	CHARGE RECEPTACLE PASS THRU
C8	BRN	358A	.35	AIR BAG INDICATOR IPC
C9	BRN/WHT	419A	.35	IPC SERVICE NOW INDICATOR
C10	PPL	524A	.35	HEADLAMP SWITCH HIGH BEAM IN
C11	YEL	525A	.35	HEADLAMP SWITCH LOW BEAM IN
C12	LT BLU	166	.35	RSA RH WINDOW DOWN
C13	RED/BLK	780A	.35	LH DOOR LOCK SWITCH - LOCK
C14	BLK	1051	.35	RADIO GROUND
C15	WHT	852A	.35	BTCM ABS INDICATOR
C16	WHT	2027A	.35	CHARGER RECEPTACLE

HARNESS CONNECTOR FACES

RIGHT HAND JUNCTION BLOCK (J12)

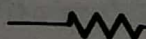


PSMELC67249AA

TAN

12110112

Location: Passenger Compartment, Under Right Side of I/P



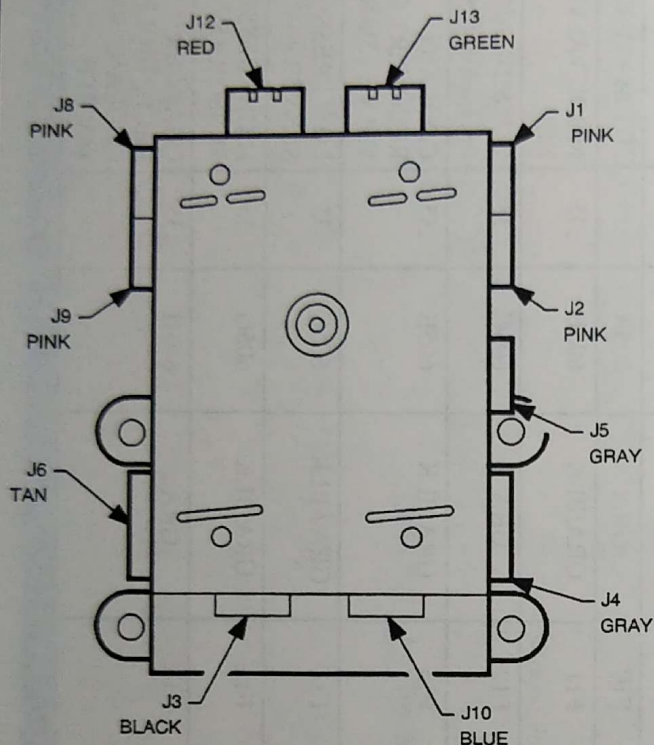
HARNESS CONNECTOR FACES

RIGHT HAND JUNCTION BLOCK - J12 - 12110112

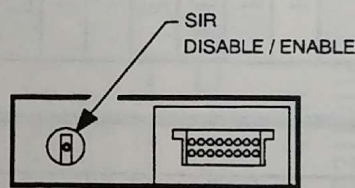
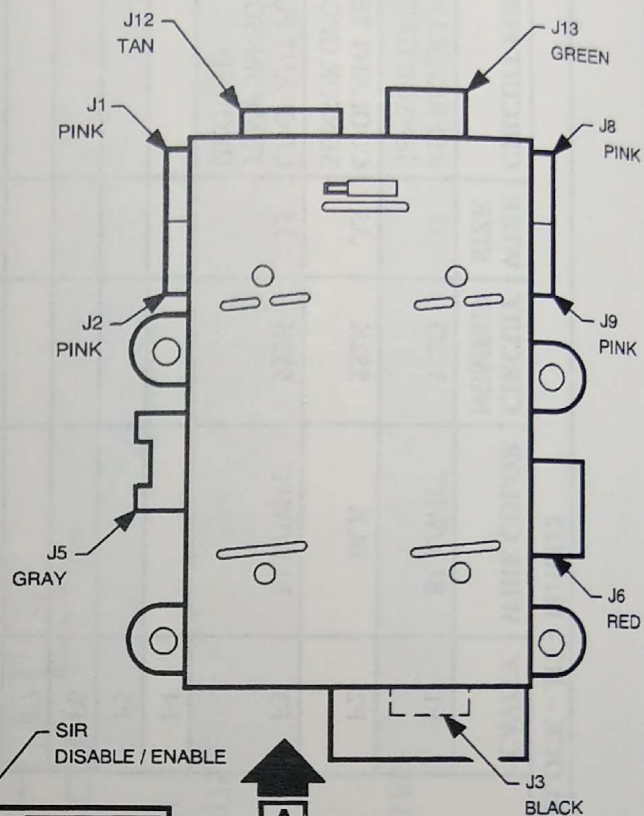
CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
E1	BLK/WHT	350H	.35	HTCM GROUND
E2	BLK	350S	.35	BPM GROUND
E3	BLK/WHT	350B	.35	HIGH NOTE HORN GROUND
E4	BLK	350A	.35	LOW NOTE HORN GROUND
E5	BLK/WHT	350G	.35	RF MARKER LAMP GROUND
E6	BLK/WHT	1751	.35	SDM GROUND
E7	BLK/WHT	350C	.50	RF PARK/TURN LAMP GROUND
E8	BLK	350E	.35	BPM GROUND
E9				
E10				
E11	BLK	552B	.35	LOW PRESSURE SENSOR GROUND
E12	BLK	552C	.35	HIGH PRESSURE SENSOR GROUND
E13	BLK/WHT	350R	.35	REVERSING VALVE GROUND
E14	BLK	350K	.35	BPM GROUND
E15	BLK/WHT	552E	.35	DISCHARGE TEMP SENSOR
E16	BLK	552F	.35	OUTSIDE TEMP SENSOR GROUND

CAVITY	WIRE COLOR	CIRCUIT NUMBER	WIRE SIZE	CIRCUIT FUNCTION
F1	BLK/WHT	552G	.35	REFRIGERANT TEMP SENSOR GROUND
F2	BLK	552K	.35	COOLANT TEMP SENSOR GROUND
F3	BLK/WHT	552H	.35	COOLANT PUMP TEMP SENSOR GROUND
F4				
F5				
F6				
F7				
F8				
F9				
F10	GRA	605A	.35	HTCM +5V REF
F11	GRA/BLK	605B	.35	MODE VALVE +5V REF
F12	GRA	605C	.35	OUTSIDE AIR VALVE ACTUATOR +5V REF
F13	GRA/BLK	605E	.35	COOLANT RECOVERY CHECK VALVE +5V REF
F14	GRA / BLK	605F	.35	LOW PRESSURE SENSOR +5V REF
F15	GRA/BLK	605G	.35	HIGH PRESSURE SENSOR +5V REF
F16	GRA	605H	.35	CHARGER RECEPTACLE COOLANT VALVE +5V REF

LH JUNCTION BLOCK

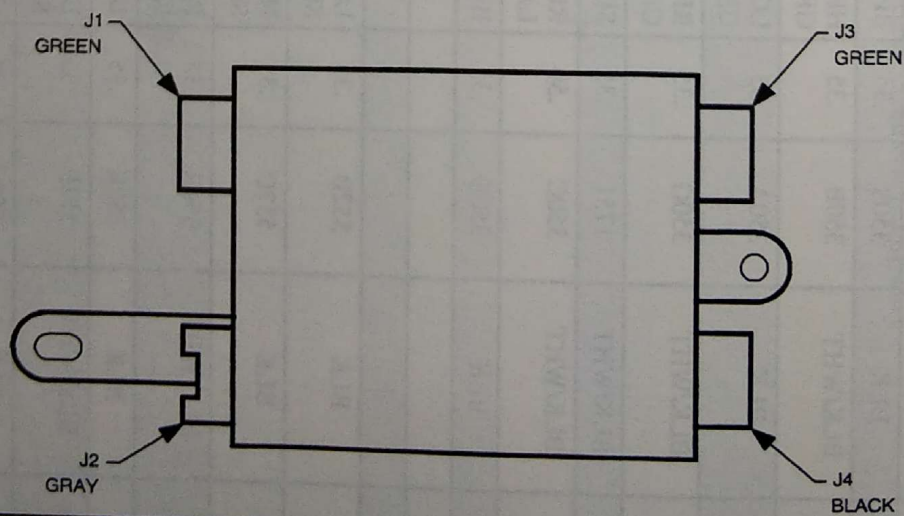


RH JUNCTION BLOCK



VIEW A

TRUNK JUNCTION BLOCK



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ACCESSORY A/C AND D/C POWER MODULE (APM)

CAUTION: TO REDUCE THE RISK OF SEVERE SHOCKS AND BURNS, THE HIGH VOLTAGE SYSTEM SHOULD BE DISABLED ANY TIME SERVICE WORK IS BEING PERFORMED ON OR AROUND THE HIGH VOLTAGE SYSTEM. WHEN IN DOUBT, ALWAYS DISABLE THE HIGH VOLTAGE SYSTEM. THE 12 VOLT SYSTEM WILL STILL BE ACTIVE AFTER THE HIGH VOLTAGE SYSTEM HAS BEEN DISABLED.

REMOVAL

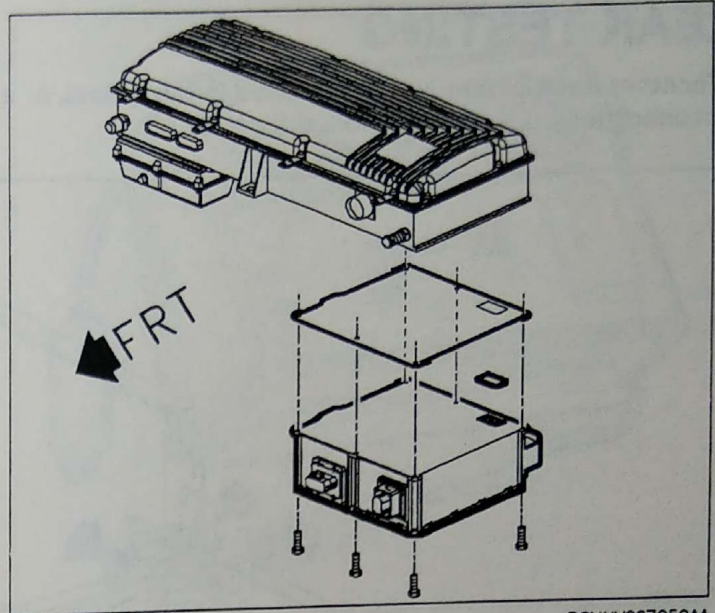
1. Remove the PEB. (Refer to the PEB removal procedure in this service manual.)
2. With the PEB removed, turn the PEB over onto a soft surface to prevent scratching or damage to the PEB cover.
3. Remove the six APM to PIM screws.
4. Carefully lift the APM straight up from the PIM until the connector is disconnected. Remove the APM.
5. Remove the APM gasket and clean the gasket surface with alcohol. The gasket must be replaced.
6. Remove the O-ring seal from the APM to PIM connector cavity.

INSTALLATION

1. Make sure the APM and PIM gasket surfaces are clean and dry. Properly align new gasket on the PIM mating surface.
2. Install new connector O-ring.
3. Position the APM above the PIM connector and carefully lower APM onto PIM connector.
4. Install the six APM to PIM screws and evenly tighten the screws and torque.

Torque: 37 N•m (50 ft-lbs)

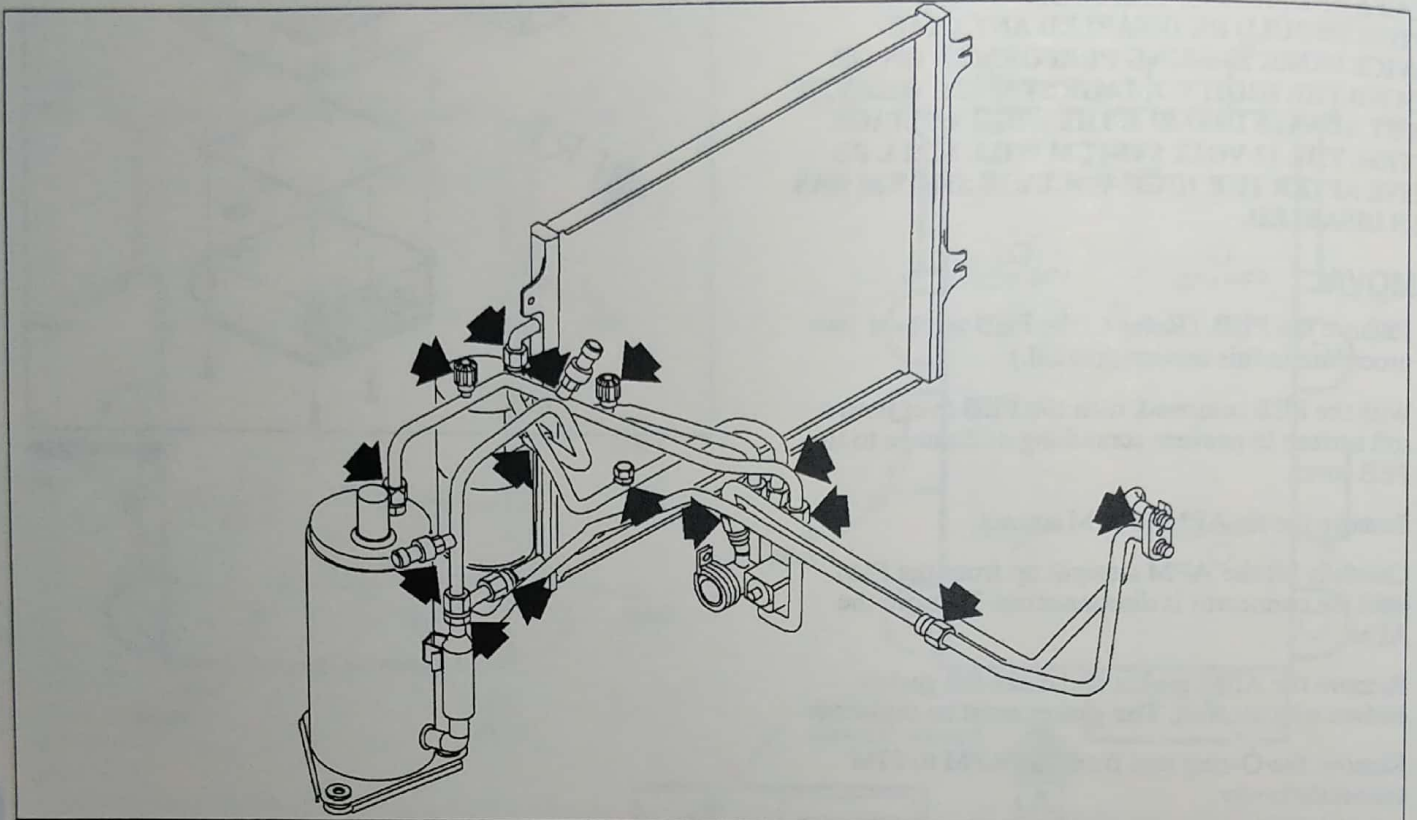
5. Install the PEB. (Refer to the PEB installation procedure in this manual.)



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LEAK TESTING

Whenever a refrigerant leak is suspected in the system, or a service operation performed which results in disturbing lines or connections, it is advisable to test for leaks.



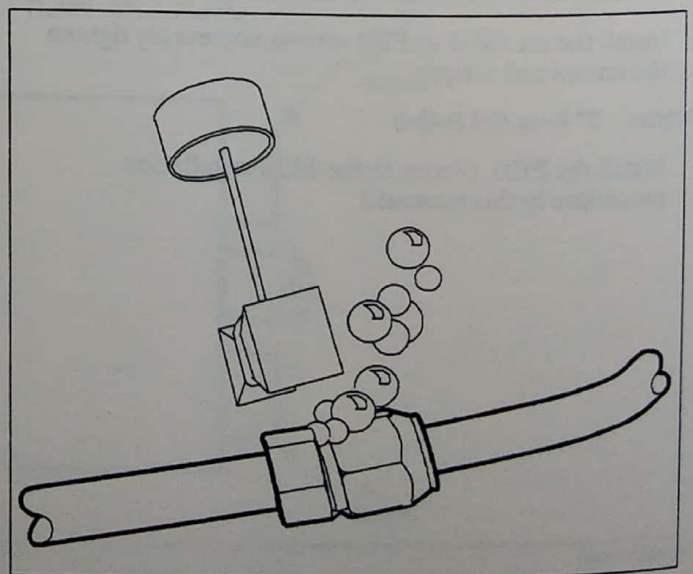
CAUTION: R-134A SERVICE EQUIPMENT OR VEHICLE HEAT PUMP SYSTEMS SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR. SOME MIXTURES OF AIR/R-134A HAVE BEEN SHOWN TO BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE. ADDITIONAL HEALTH AND SAFETY INFORMATION MAY BE OBTAINED FROM REFRIGERANT AND LUBRICANT MANUFACTURERS.

LIQUID LEAK DETECTORS

There are a number of locations (such as fittings, valves, etc.) on the heat pump system where a liquid leak detector solution may be used to pinpoint refrigerant leaks. Apply soap solution to the area in question. Bubbles will form indicating a leak.

IMPORTANT: Gauge port caps are the primary seals for the gauge port valves. They must be installed and tightened with O-ring seals in place to avoid a refrigerant leak.

IMPORTANT: Rinse soap solution from fitting before making repair.



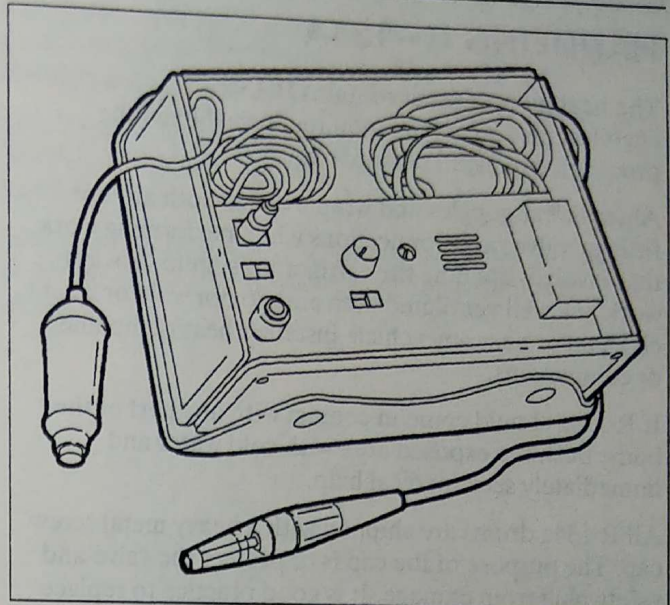
ELECTRONIC LEAK TESTERS

For restricted access areas (such as sections of evaporator and condenser) an electronic leak detector is advisable.

CAUTION: CARE SHOULD BE TAKEN TO PREVENT PERSONAL INJURY WHICH COULD OCCUR DUE TO TOUCHING A HOT COMPONENT UNDER HOOD WHEN TESTING. TESTS SHOULD BE DONE WITH THE CAR IN "LOCK" MODE AND AS COOL AS POSSIBLE. TEST SHOULD NOT BE RUN WHEN FRONT END FAN IS OPERATING. DO NOT OPERATE THE DETECTOR IN A COMBUSTIBLE ATMOSPHERE SINCE ITS SENSOR OPERATES AT A HIGH TEMPERATURE.

The successful use of this and any other electronic leak detector depends greatly upon the scan rate and upon carefully following the manufacturer's instructions regarding calibration, operation, and maintenance. Each joint must be completely circled moving at 25-50 mm (1-2 in.) per second with the tip of the probe as close to the surface as possible but no more than 6.35 mm (1/4 in.) away and without blocking air intake. A leak is indicated when the audible tone goes from a steady 1-2 clicks per second to a solid alarm. The balance knob should be adjusted frequently to maintain the 1-2 clicks per second.

IMPORTANT: Gauge port caps are the primary seals for the gauge port valves. They must be installed and tightened with O-ring seals in place to avoid a refrigerant leak.



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HANDLING R-134A

The heat pump system contains R-134a. This is a chemical mixture which requires special handling procedures to avoid personal injury.

Always wear goggles and wrap a clean cloth around fittings, valves and connections when performing work that involves opening the refrigerant system. Always work in a well ventilated area and do not weld or steam clean on or near any vehicle installed heat pump lines or components.

If R-134a should come in contact with any part of the body, flush the exposed area with cold water and immediately seek medical help.

All R-134a drums are shipped with a heavy metal screw cap. The purpose of the cap is to protect the valve and safety plug from damage. It is good practice to replace the cap after each use of the drum for this same reason.

If it is necessary to transport or carry any container of R-134a in a vehicle, do not carry it in the passenger compartment.

The refrigerant system may be evacuated and charged using an air conditioning service charging station or a manifold and gauge set and a drum of R-134a (13.6 kg [30 lbs.]).

Before removing and replacing any of the heat pump refrigeration lines or components, the R-134a must be completely recovered from the system using an approved refrigerant recovery system.

Always use service valve and charging station equipment or pressure gauge sets during evacuation and charging procedures.

CAUTION: DO NOT CONNECT ANY LINE TO THE LOW SIDE SERVICE FITTING DURING CHARGING PROCEDURE.

MAINTAINING CHEMICAL STABILITY IN THE REFRIGERATION SYSTEM

The efficient operation and life of the heat pump system is dependent upon the chemical stability of the refrigeration system. When foreign materials, such as dirt, air, or moisture contaminate the refrigeration system, they will change the stability of the R-134a and viscosity of refrigerant oil. They will also affect pressure-temperature corrosion and abnormal wear of moving parts.

ADDING OIL

Adding oil to the heat pump system should take place after recovery and evacuation. Follow oil charge replenishing instructions provided with the charging station in use with the following exceptions:

1. Use only EV compressor oil (Ester oil), P/N 27002486.
2. Use a clean oil bottle on charge station.

OIL DISTRIBUTION

EV1 heat pump system requires 480 ml (16.3 oz.) of Polyol Ester compressor oil. Service compressors have 480 ml (16.3 oz.) of Ester oil installed.

New oil quantities must be added to system during component replacement and conditions stated as follows:

With no signs of excessive oil leakage, add:

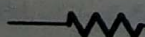
- a. Compressor – Remove, drain and measure oil. Drain replacement compressor. Add the same amount of new Ester compressor oil drained from removed compressor to replacement compressor. (Refer to "Compressor" section for details.)
- b. Evaporator – Add 50 ml (1.7 oz.) of new Ester compressor oil.
- c. Condenser – Add 50 ml (1.7 oz.) of new Ester compressor oil.
- d. Accumulator – Remove drain and measure oil. Add the same amount of new Ester compressor oil drained from the removed accumulator to the replacement accumulator plus. Add 25 ml (.85 oz.) of new Ester compressor oil even if no oil is present in the replaced accumulator.

REFRIGERANT OIL LOSS DUE TO A LARGE LEAK

If the refrigerant charge is abruptly lost due to a large refrigerant leak, (line rupture or collision), approximately 50 ml (1.7 oz.) of refrigerant oil will be carried out of the system suspended in the refrigerant. Any failure that caused an abrupt refrigerant discharge will cause the oil loss. Conditions that allow the refrigerant to seep or bleed off over time do not cause this oil loss.

Upon replacement of a component which caused a large refrigerant leak, add 50 ml (1.7 oz.) of new Ester compressor oil plus the required amount of oil for the particular component (as outlined previously).

Add the oil directly to the replaced component if possible. If the oil cannot easily be added to the replaced part, add oil after evacuation and before recharge (as outlined previously).



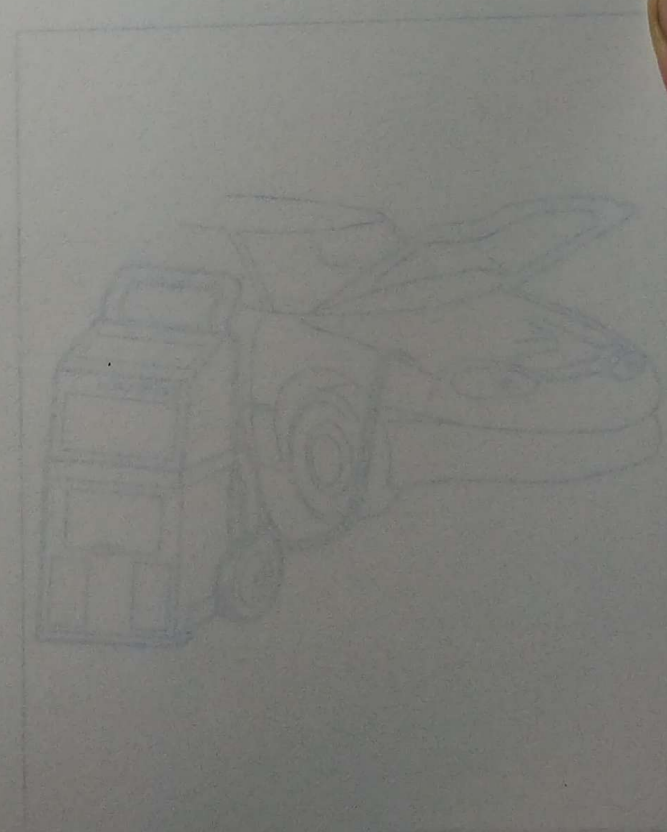
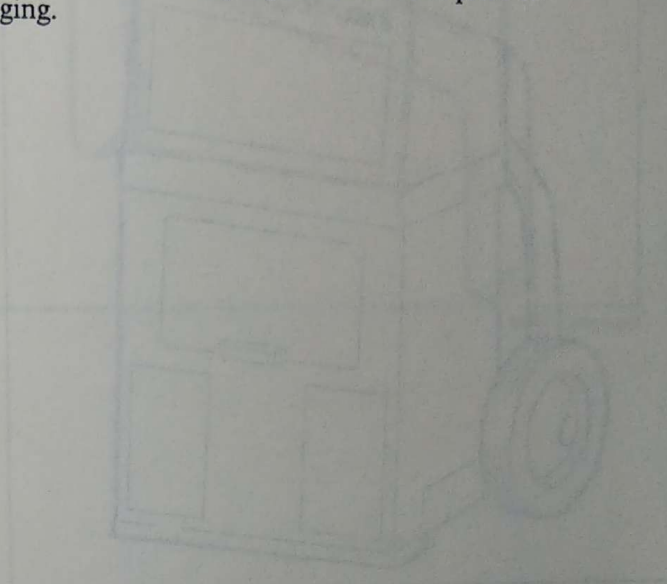
RECOVERING, EVACUATING, AND CHARGING THE HEAT PUMP SYSTEM

CAUTION: NEVER CHARGE THE HEAT PUMP SYSTEM THROUGH THE LOW PRESSURE SIDE OF THE SYSTEM. COMPONENT DAMAGE AND PERSONAL INJURY COULD RESULT.

NOTICE: Under no circumstances should alcohol be used in the system in an attempt to remove moisture. Damage to the system components could occur.

If the system has been opened for any repair, or the R-134a charge lost, the system must be evacuated prior to charging.

Evacuation and charging is a combined procedure and all gauge lines must be purged with R-134a prior to charging.



HEAT PUMP SYSTEM R-134A RECOVERY

Before removing or replacing any of the heat pump refrigerant lines or components, the refrigerant must be completely recovered.

The refrigerant system must be discharged using an air conditioning refrigerant recovery and recycling system. Follow the manufacturer's operating instructions for system being used.

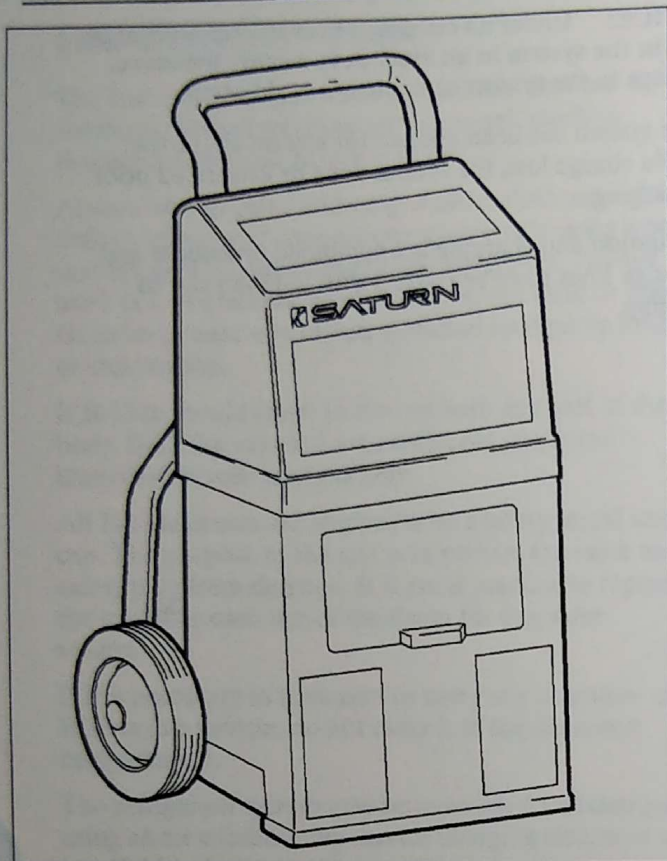
NOTICE: The air conditioning refrigerant and recycling station must meet UL standards for moisture and contamination removal. Recovery system which cannot meet these standards are not approved for warranty repairs. Reuse of moisture or particulate contaminated refrigerant will result in premature compressor and other component failure.

Always check heat pump system for pressure with a manifold gauge set to determine if refrigerant is present in the system. Performing recovery on a heat pump system which is open to atmosphere as a result of a leak, would allow the recovery station to pull only air into the tank.

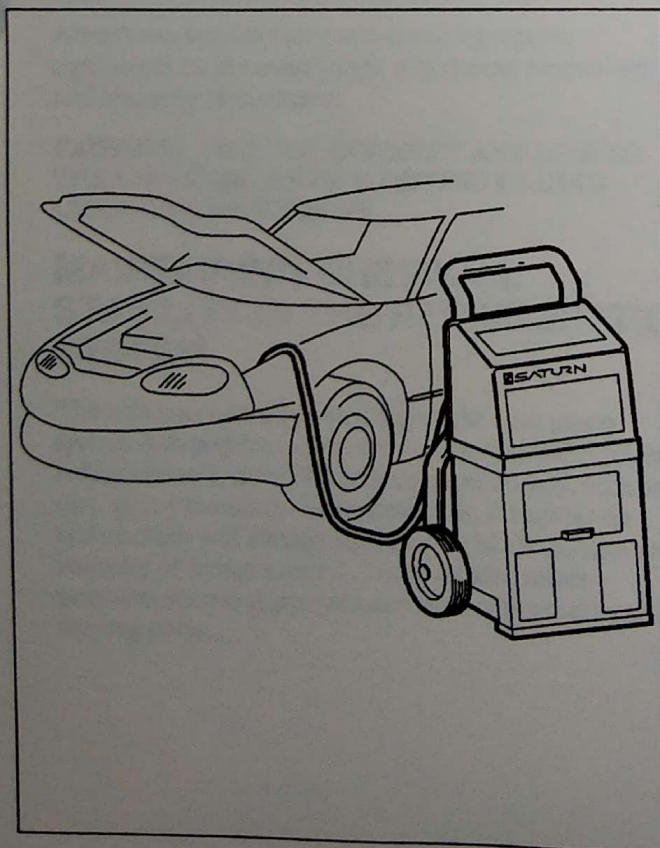
NOTICE: Failure to check for residual oil from the previous recovery can result in adding extra oil to the vehicle currently being serviced. This will also result in insufficient oil in the system previously worked on and could possibly contribute to premature compressor failure.

EVACUATING THE SYSTEM

1. Install new Electric Vehicle approved service replacement heat pump schrader valves prior to evacuating system. Even though a schrader valve may look the same, it is extremely important that only recommended service replacement heat pump schrader valves be used or leakage of refrigerant will occur.
2. The refrigerant system must be evacuated using an air conditioning refrigerant recovery and recycling system. Follow the manufacture's operating instructions for system being used.
3. Allow system to evacuate for the predetermined time on the refrigerant recovery and recycling system. Note vacuum gauge readings.
4. Watch low side gauge for vacuum loss (one to three minutes). If loss is less than 3.38 kPa (1 in. Hg) from level recorded in Step 3, proceed to charging the heat pump system.
5. If vacuum loss is greater than 3.38 kPa (1 in. Hg) from level recorded in Step 3, charge with 0.23 kg (1/2 lb.) R-134a. Leak test, repair leaks, and re-test.



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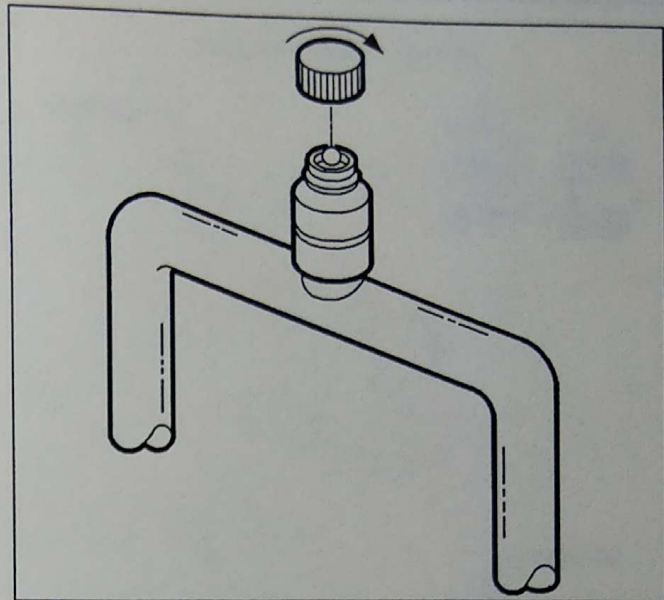
CHARGING THE HEAT PUMP SYSTEM

The refrigerant system must be charged using a R-134a air conditioning refrigerant charging system. Follow the manufacturer's operating instructions for system being used with the following exceptions.

1. Do not connect low pressure line to the heat pump system.
2. Keep the low pressure valve on the charging station closed at all times.
3. Perform the entire charge procedure through the high-pressure service fitting on the discharge pipe.
4. Charge the heat pump system with 0.91 kg (2.0 lbs.) of R-134a refrigerant.

IMPORTANT: Make sure there is an O-ring seal inside of caps before installation because the cap is the primary seal for heat pump system service fittings. Failure to tighten cap will result in refrigerant leakage.

5. Install protective caps on service fittings and hand tighten.
6. Leak check system with electronic leak detector or equivalent.
7. With system fully charged and leak-checked, conduct a functional and performance test. (Refer to Diagnostic flow chart.)



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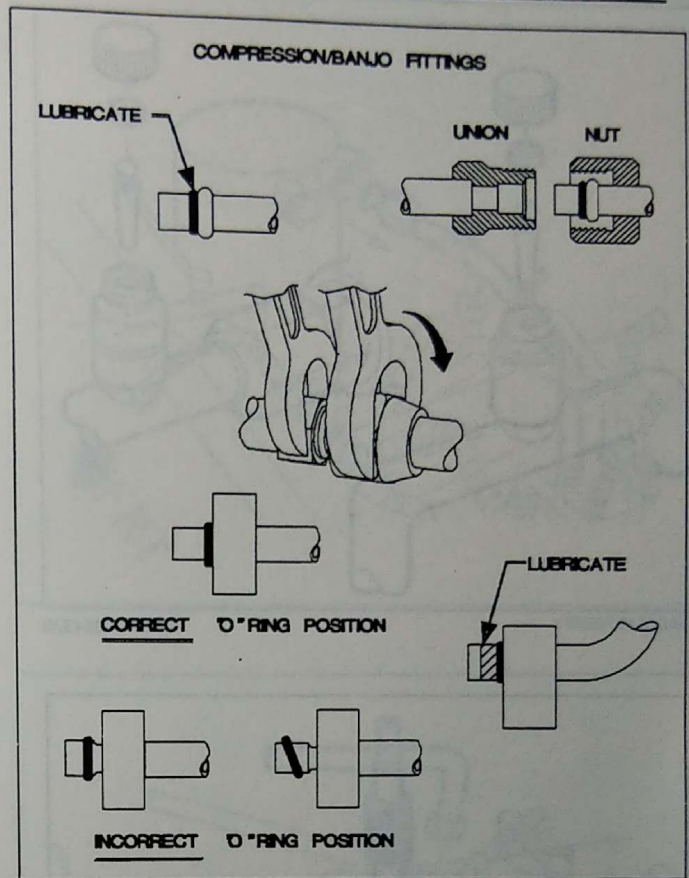
HANDLING REFRIGERANT LINES AND FITTINGS

1. Clean tools and a clean work area are important for proper heat pump system service. Joints, fittings, and components should be cleaned before any on-vehicle repairs. Clean with solvent, dry with air and use only lint free cloths to wipe parts.
2. All metal tubing lines should be free of dents or kinks to prevent loss of system capacity due to line restrictions.
3. When disconnecting any fitting in the refrigeration system, the system must first be discharged of all the R-134a. Using an approved refrigerant recovery system, proceed very cautiously regardless of gauge readings. Injury can occur if there happens to be liquid R-134a in the line. If pressure is noticed when fitting is loosened, re-tighten fitting and recover remaining refrigerant.
4. In the event any refrigerant line is opened to the atmosphere, it should be capped or taped to prevent entrance of moisture and dirt, which can cause internal compressor wear or plugged lines in condenser and evaporator core. Always replace O-rings on any lines that are removed.
5. The use of the proper wrenches when making connections on the O-ring fitting is important. The opposing fitting should always be backed up with a wrench to prevent distortion of connection lines or components.
6. Tighten all tubing connections as shown in chart. Insufficient or excessive torque when tightening can result in loose joints or deformed parts. Either condition can result in refrigerant leakage.
7. O-rings and seats must be in perfect condition. A burr or piece of dirt may cause a refrigerant leak. When replacing the O-ring, first coat it with clean R-12 refrigerant oil and position on line as shown.

O-RINGS

NOTICE: Use only R-12 Refrigerant oil (mineral) to lubricate O-rings. Use of R-134a (PAG) oil or R-134a heat pump (Ester) oil will cause premature corrosion of fitting joints.

1. Install new Electric Vehicle service replacement heat pump system O-rings whenever a joint or fitting is disassembled, except when provided on new components. Even though an O-ring may look the same, it is extremely important that only recommended service replacement heat pump system O-rings be used or leakage of refrigerant will occur.
2. When replacing O-rings on a heat pump component or joint reconnection, the fitting design should be carefully identified to ensure installation of the correct heat pump service replacement O-ring. Use a non-metal tool (e.g. plastic pick) to remove O-ring to avoid damaging the mating surface on the fitting.
3. O-ring should be coated with new R-12 mineral compressor oil prior to installation, but must not be soaked.
4. Prior to installation, verify that both the O-rings and fittings have not been nicked or deformed. Deformed or nicked parts must be replaced. Failure to use proper service replacement parts and procedures may result in excessive refrigerant leakage.

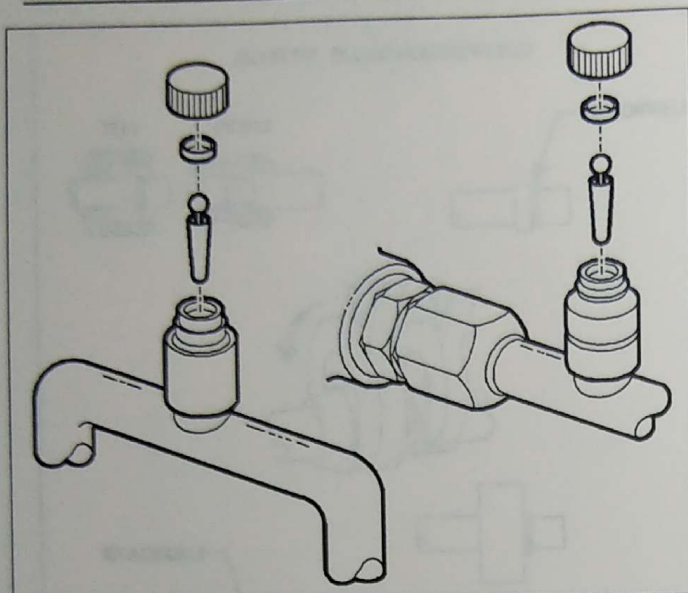


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SERVICE GAUGE PORT VALVES

The heat pump refrigerant system has a high pressure (discharge) and a low pressure (suction) gauge port valve. These valves provide access to both sides (high and low pressure) of the system. Always replace the valves after recovery of refrigerant is complete and prior to evacuation procedure. Always install the protector cap on the gauge port valves after servicing the heat pump system to avoid refrigerant from escaping.

IMPORTANT: Gauge port caps are the primary seals for the gauge port valves. They must be installed and tightened with O-ring seals in place to avoid a refrigerant leak.



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VALVE CORE

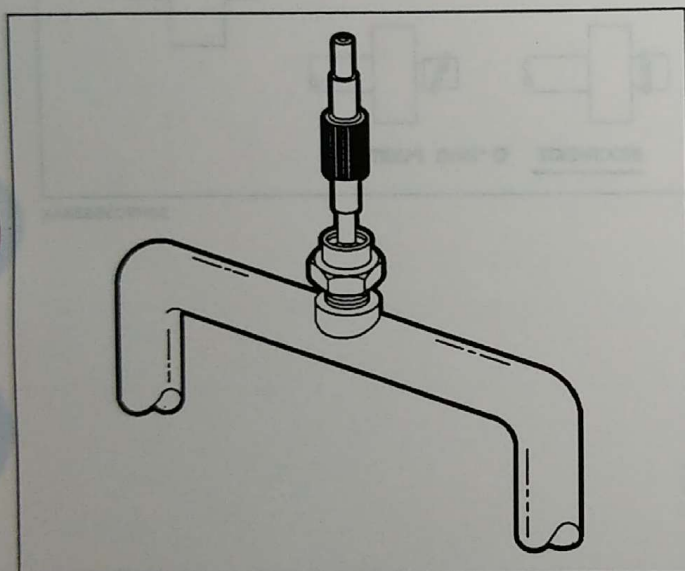
REMOVAL

1. Discharge refrigerant system using an approved refrigerant recovery system.
2. Remove valve core using tool number SA9149AC-7.

INSTALLATION

1. Install and tighten valve core with tool number SA9149AC-7.
2. Evacuate, charge, and leak test heat pump system.

NOTICE: To prevent loss of refrigerant charge, make sure to install and tighten cap. Replace cap if seal is missing or damaged.



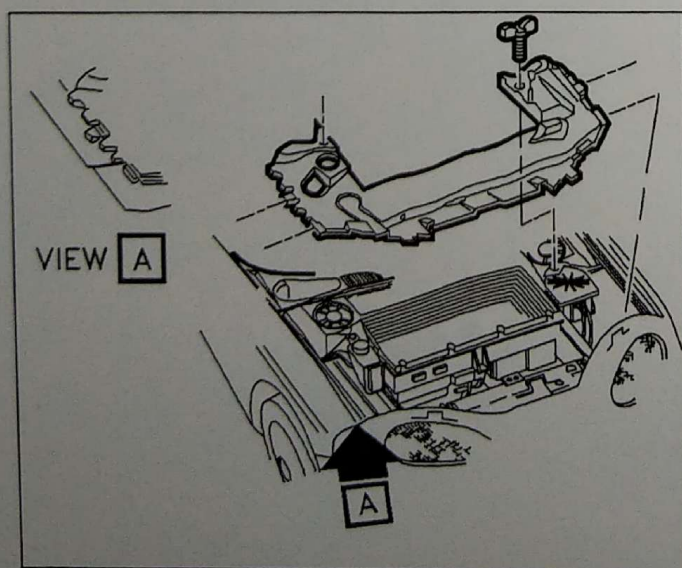
PSMHVC66648AA

A/C ACCUMULATOR TUBE ASSEMBLY

REVERSING VALVE TO ACCUMULATOR

REMOVAL

1. Place keypad in "lock" mode.
2. Remove engine compartment sight shield.
3. Recover refrigerant using an approved refrigerant recovery system.

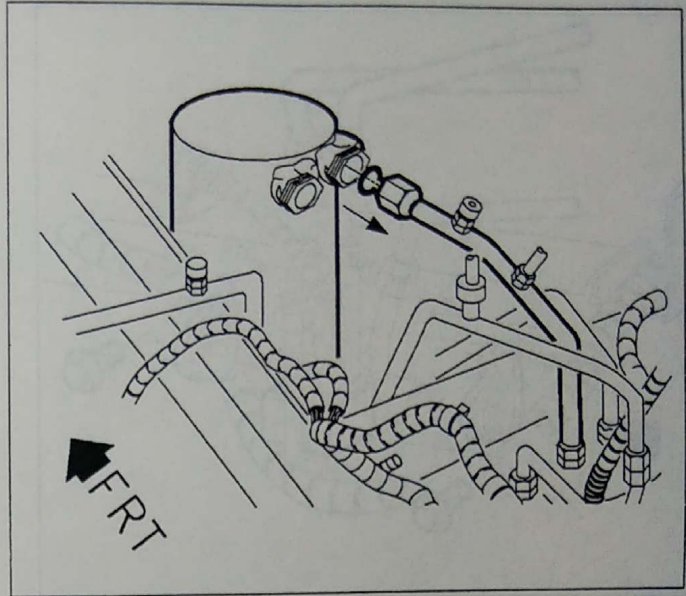


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4. Verify charge coupler is not installed in charger receptacle.
5. Remove power electronics bay. (Refer to "Power Electronics Bay" removal procedure in this manual.)

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

6. Disconnect accumulator tube from accumulator.

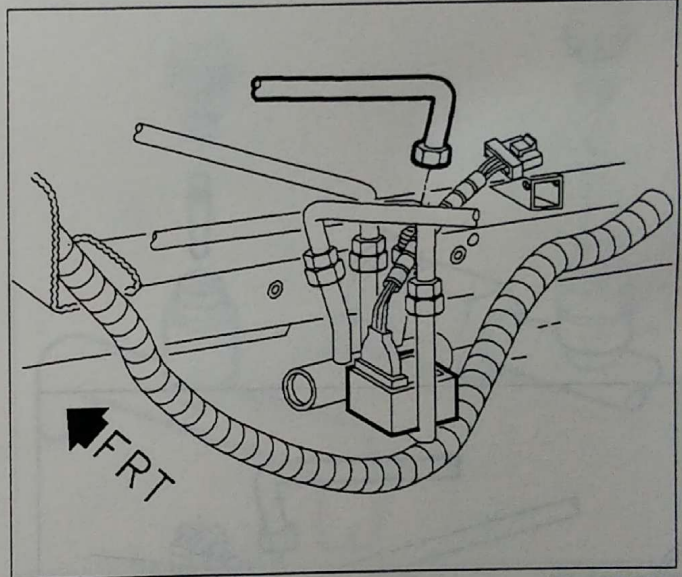


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7. Remove reversing valve retainers from front lower tie bar.

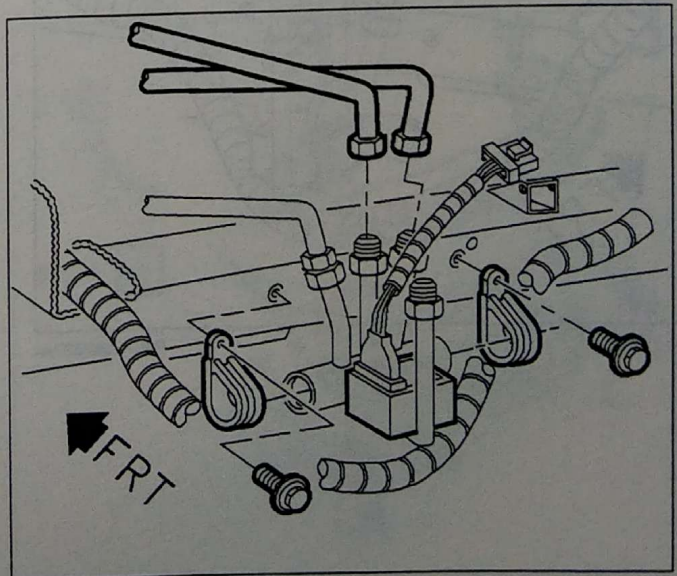
NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

8. Disconnect condenser tube from reversing valve.



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9. Disconnect temperature sensor, if equipped, on the accumulator tube.
10. Disconnect accumulator tube from reversing valve.
11. Remove accumulator tube from vehicle.



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INSTALLATION

IMPORTANT: If vehicle is equipped with a temperature sensor in the accumulator tube and the replacement accumulator tube does not have a sensor inline, then the condenser tube (reversing valve to condenser) will also need to be replaced. Connect temperature sensor connector to sensor on condenser tube.

1. Remove protective cover from reversing valve fitting of accumulator tube.

NOTICE: Use only R-12 refrigerant oil (mineral) to lubricate O-rings. Use of R-134a (PAG) oil or R-134a heat pump (Ester) oil will cause premature corrosion of fitting joints.

2. Lubricate O-ring with R-12 mineral refrigerant oil.
3. Position accumulator tube in vehicle.

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

4. Connect accumulator tube to reversing valve.

Torque: 20 N•m (15 ft–lbs)

5. Remove O-ring from condenser tube fitting and install a new Electric Vehicle approved service replacement O-ring.

NOTICE: Use only R-12 Refrigerant oil (mineral) to lubricate O-rings. Use of R-134a (PAG) oil or R-134a heat pump (Ester) oil will cause premature corrosion of fitting joints.

6. Lubricate O-ring with R-12 mineral refrigerant oil.

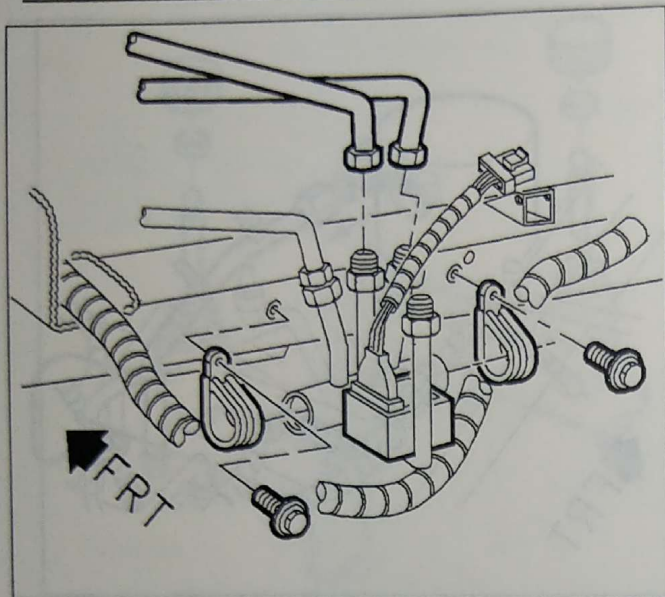
NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

7. Connect condenser tube to reversing valve.

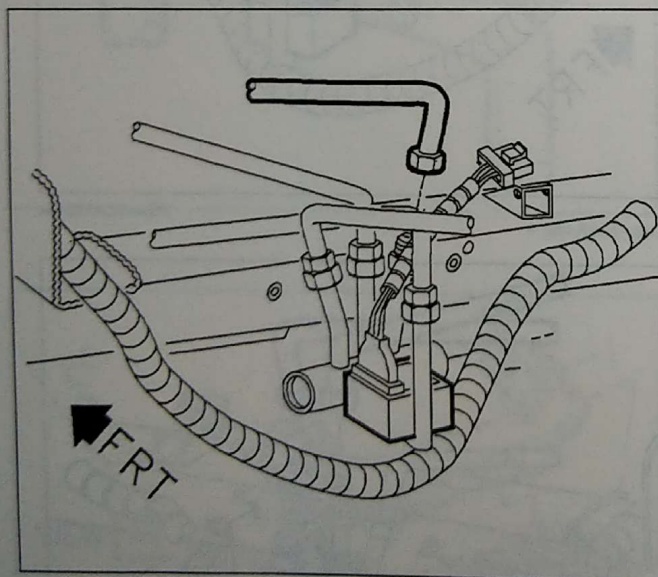
Torque: 20 N•m (15 ft–lbs)

8. Install reversing valve retainers to front lower tie bar.

Torque: 10 N•m (7 ft–lbs)



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9. Remove protective cover from accumulator fitting of accumulator tube.

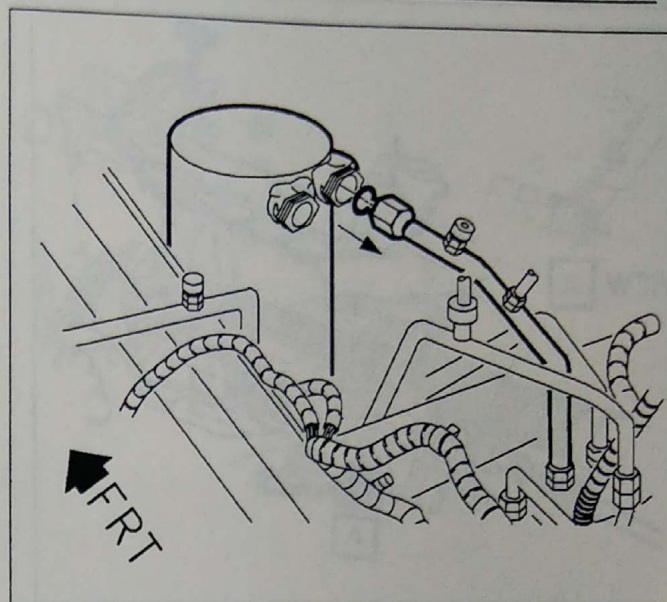
NOTICE: Use only R-12 Refrigerant oil (mineral) to lubricate O-rings. Use of R-134a (PAG) oil or R-134a heat pump (Ester) oil will cause premature corrosion of fitting joints.

10. Lubricate O-ring with R-12 mineral refrigerant oil.

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

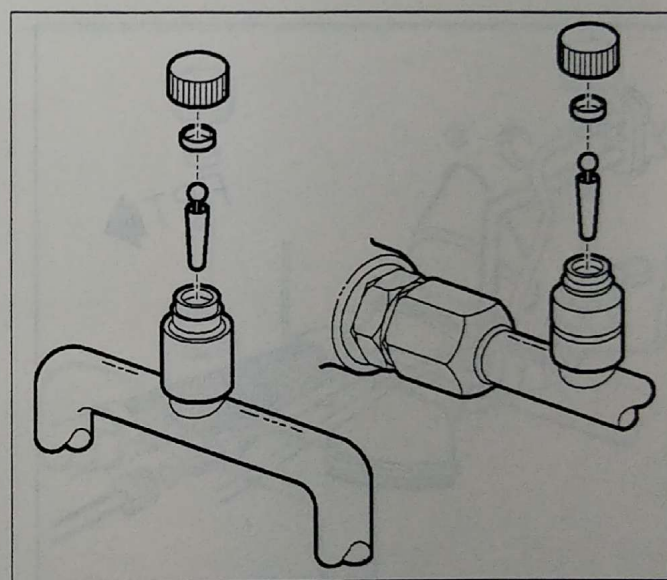
11. Connect accumulator tube to accumulator.

Torque: 20 N•m (15 ft–lbs)



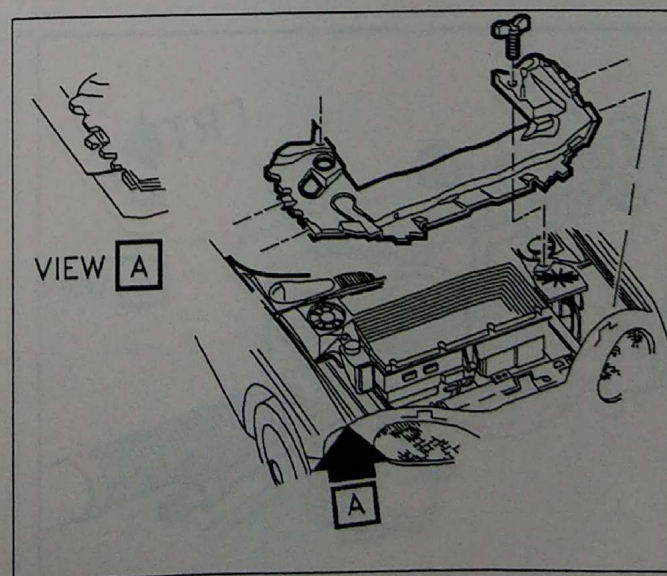
PSMHVC66502AA

12. Install new Electric Vehicle approved service replacement heat pump schrader valves.
13. Evacuate, charge, and leak test heat pump system.
14. Install power electronics bay. (Refer to "Power Electronics Bay" installation procedure in this manual.)
15. Verify heat pump system operation by performing system performance test.



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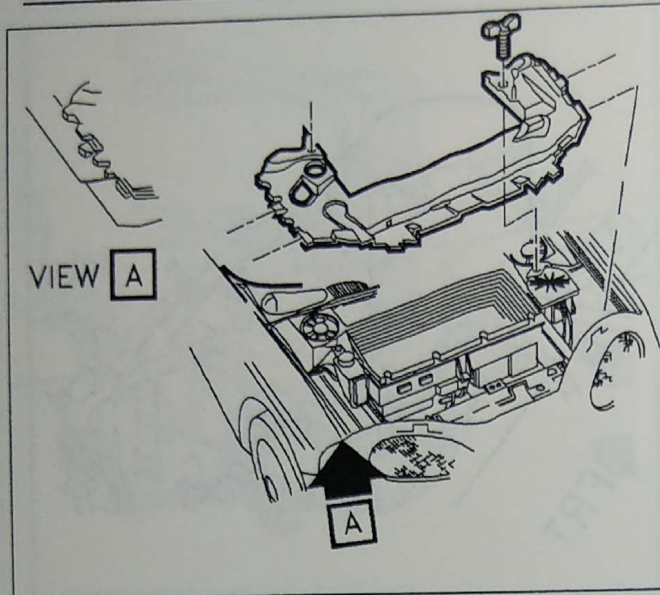
16. Install engine compartment sight shield.



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A/C EVAPORATOR TUBE ASSEMBLY ORIFICE TO EVAPORATOR REMOVAL

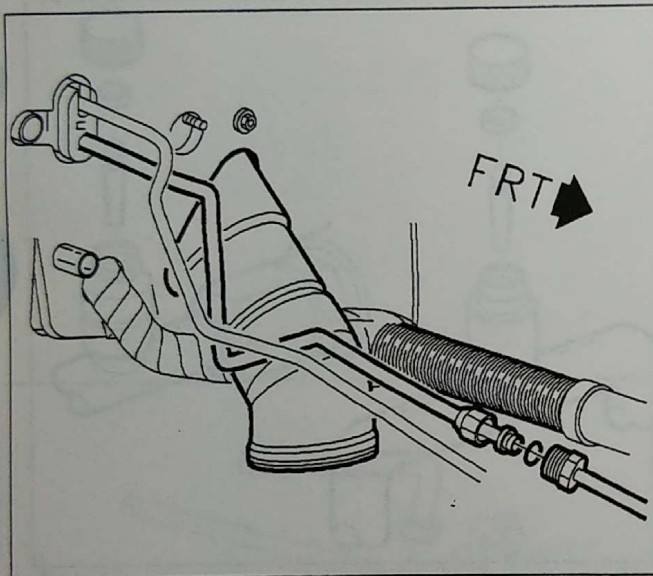
1. Place keypad in "lock" mode.
2. Remove engine compartment sight shield.
3. Recover refrigerant using an approved refrigerant recovery system.
4. Verify charge coupler is not installed in charger receptacle.
5. Remove power electronics bay. (Refer to "Power Electronics Bay" removal procedure in this service manual.)



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NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

Disconnect evaporator tube at orifice tube fitting.



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6. Remove nut retaining tubes at front of dash.
7. Disconnect evaporator tube from evaporator.
8. Remove evaporator tube from vehicle.

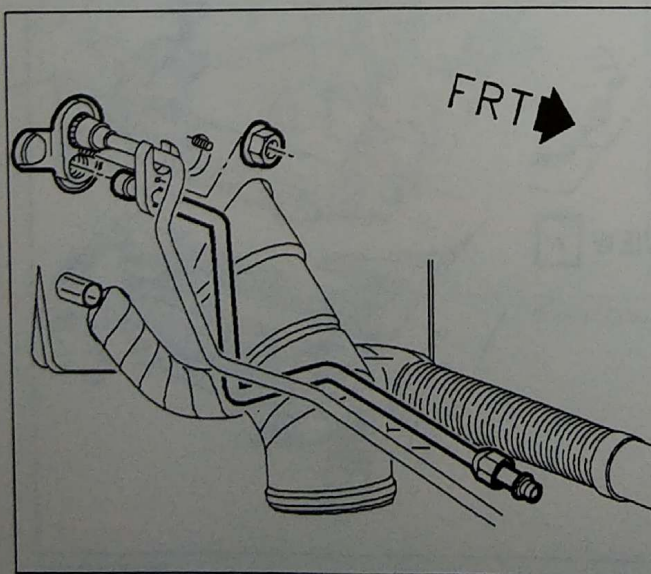
INSTALLATION

1. Remove protective cover from evaporator fitting of evaporator tube.

NOTICE: Use only R-12 Refrigerant oil (mineral) to lubricate O-rings. Use of R-134a (PAG) oil or R-134a heat pump (Ester) oil will cause premature corrosion of fitting joints.

2. Lubricate O-ring with R-12 mineral refrigerant oil.
3. Position evaporator tube in vehicle.
4. Connect evaporator tube to evaporator.

Torque: 16 N•m (12 ft-lbs)



PSMHVC66802AA

5. Remove protective cover from orifice tube fitting of evaporator tube.

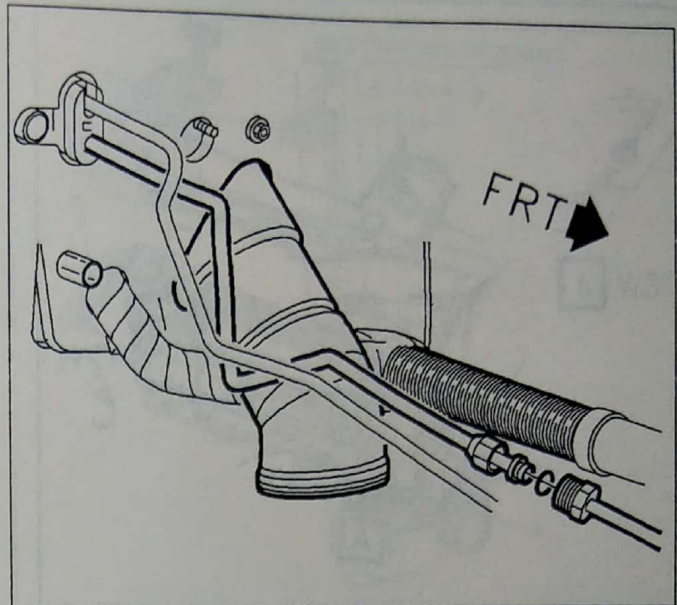
NOTICE: Use only R-12 Refrigerant oil (mineral) to lubricate O-rings. Use of R-134a (PAG) oil or R-134a heat pump (Ester) oil will cause premature corrosion of fitting joints.

6. Lubricate O-ring with R-12 mineral refrigerant oil.

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

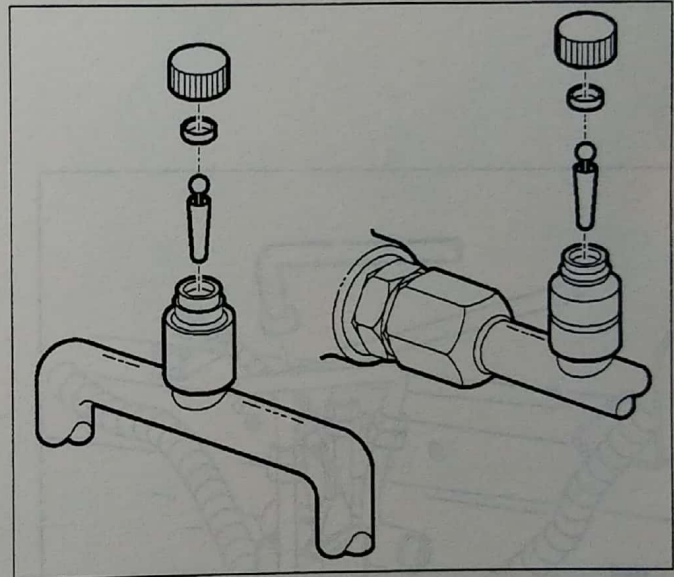
7. Connect evaporator tube to orifice tube fitting.

Torque: 20 N•m (15 ft-lbs)



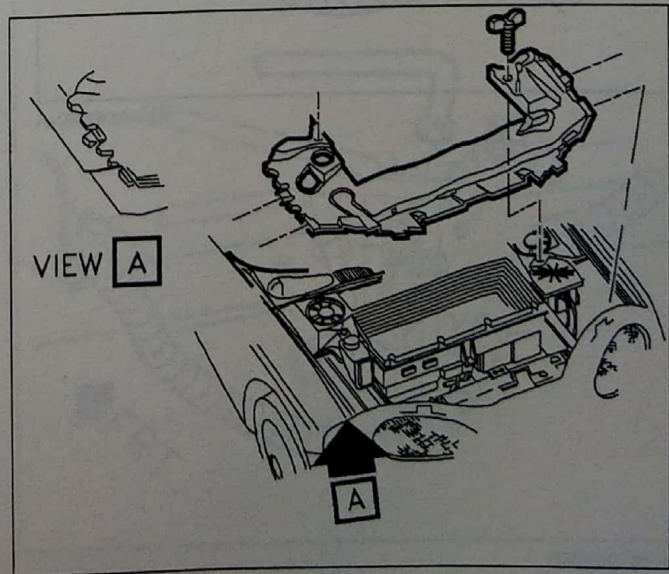
PSMHVC66995AA

8. Install new Electric Vehicle approved service replacement heat pump schrader valves.
9. Evacuate, charge, and leak test heat pump system.
10. Install power electronics bay. (Refer to "Power Electronics Bay" installation procedure in this service manual.)
11. Verify heat pump system operation by performing system performance test.

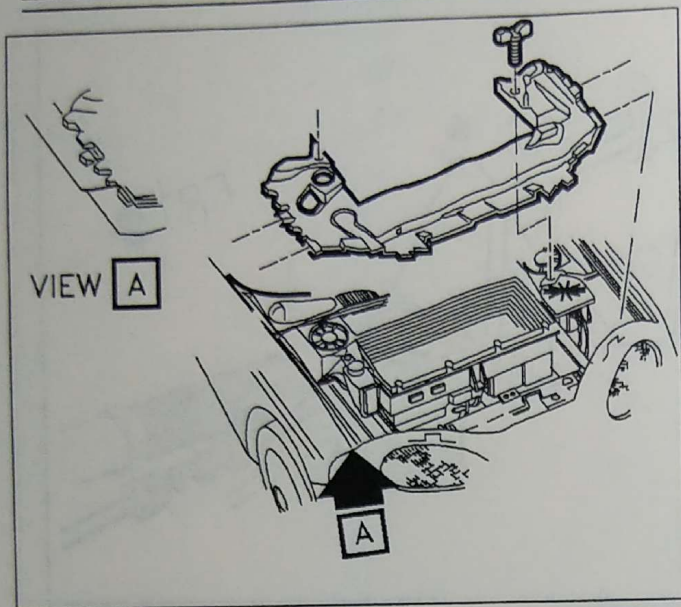


PSMHVC66647AB

12. Install engine compartment sight shield.



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PSMGEP65869AC

A/C CONDENSER TUBE ASSEMBLY REVERSING VALVE TO CONDENSER REMOVAL

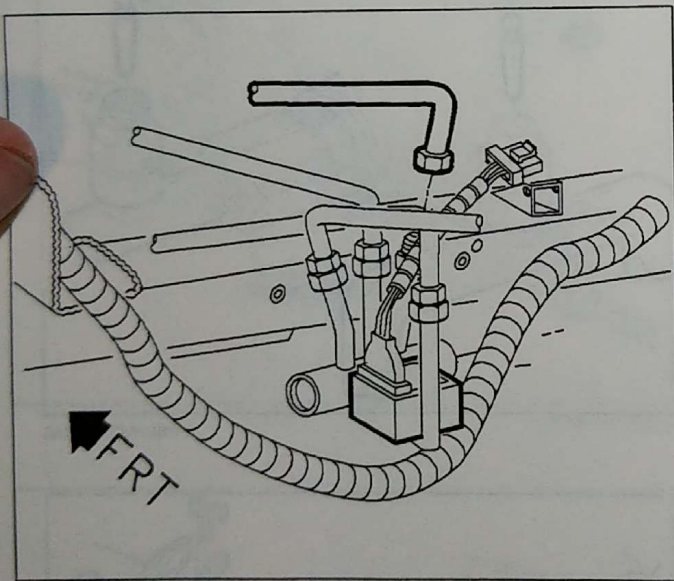
1. Place keypad in "lock" mode.
2. Remove engine compartment sight shield.
3. Recover refrigerant using an approved refrigerant recovery system.

CAUTION: TO REDUCE THE RISK OF SEVERE SHOCKS AND BURNS, THE HIGH VOLTAGE SYSTEM SHOULD BE DISABLED ANY TIME SERVICE WORK IS BEING PERFORMED ON OR AROUND THE HIGH VOLTAGE SYSTEM. WHEN IN DOUBT, ALWAYS DISABLE THE HIGH VOLTAGE SYSTEM. THE 12 VOLT SYSTEM WILL STILL BE ACTIVE AFTER THE HIGH VOLTAGE SYSTEM HAS BEEN DISABLED.

4. Disable high voltage. (Refer to "High Voltage Disable" procedure in this manual.)
5. Verify charge coupler is not installed in charger receptacle.

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

6. Disconnect condenser tube from reversing valve.



PSMHVC67387AA

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

7. Disconnect condenser tube from upper fitting on condenser.
8. Remove condenser tube from vehicle.

INSTALLATION

1. Remove protective cover from condenser fitting of condenser tube.

NOTICE: Use only R-12 Refrigerant oil (mineral) to lubricate O-rings. (Use of R-134a (PAG) oil or R-134a heat pump (Ester) oil will cause premature corrosion of fitting joints.)

2. Lubricate O-ring with R-12 mineral refrigerant oil.
3. Position condenser tube in vehicle. Route tube under accumulator tube and over the reversing valve tube.

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

4. Connect condenser tube to upper fitting on condenser.

Torque: 20 N•m (15 ft–lbs)

5. Remove protective cover from reversing valve fitting of condenser tube.

NOTICE: Use only R-12 Refrigerant oil (mineral) to lubricate O-rings. (Use of R-134a (PAG) oil or R-134a heat pump (Ester) oil will cause premature corrosion of fitting joints.)

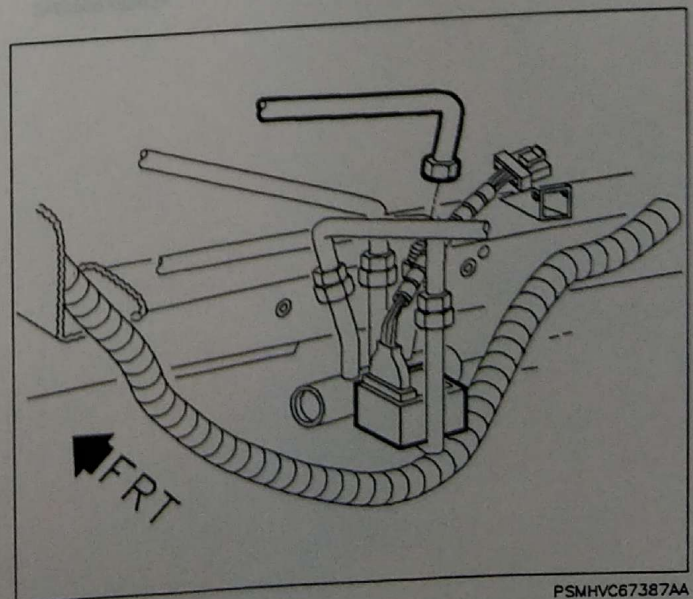
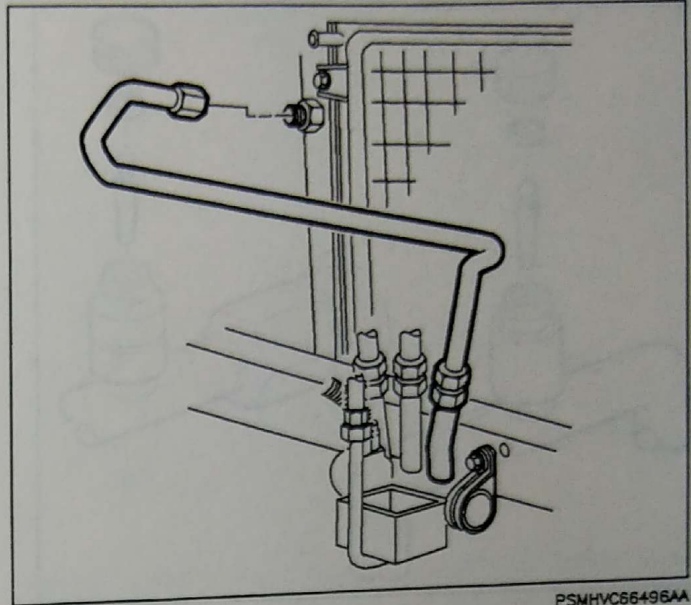
6. Lubricate O-ring with R-12 mineral refrigerant oil.

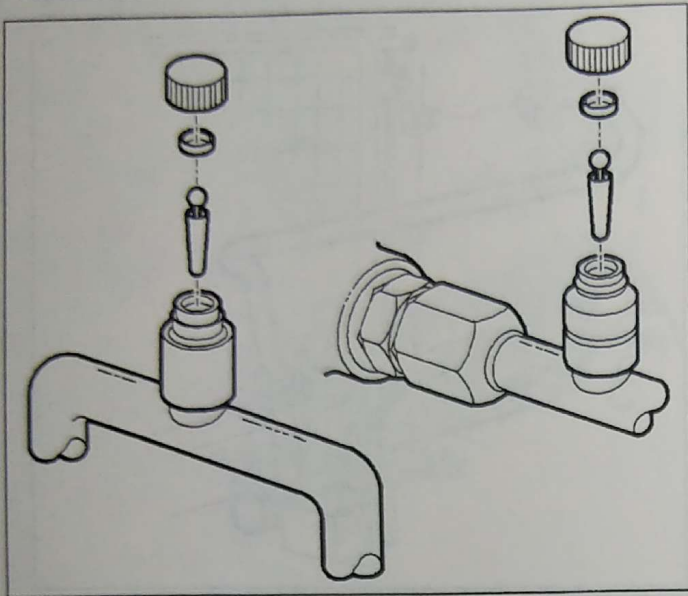
NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

7. Connect condenser tube to reversing valve.

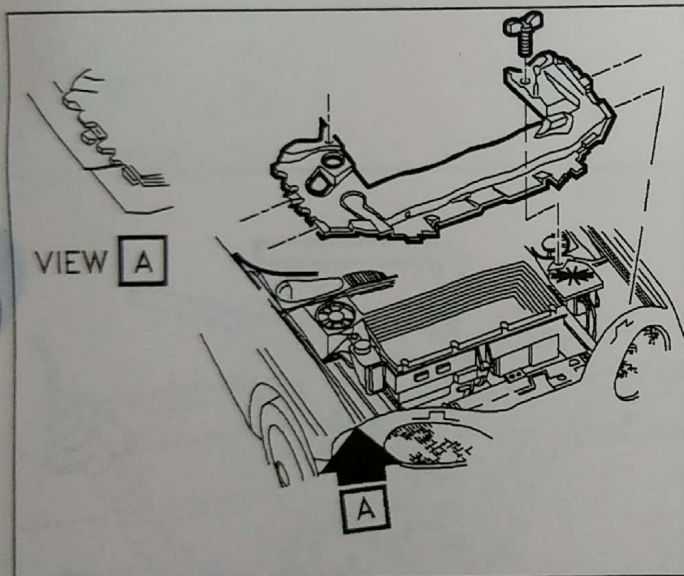
Torque: 20 N•m (15 ft–lbs)

8. Enable high voltage. (Refer to "High Voltage Enable" procedure in this manual.)





PSMHVC66647AB



PSMGEP65869AC

9. Install new Electric Vehicle approved service replacement heat pump schrader valves.
10. Evacuate, charge, and leak test heat pump system.
11. If new condenser tube has a temperature sensor in line, connect temperature sensor connector.
12. Verify heat pump system operation by performing system performance test.

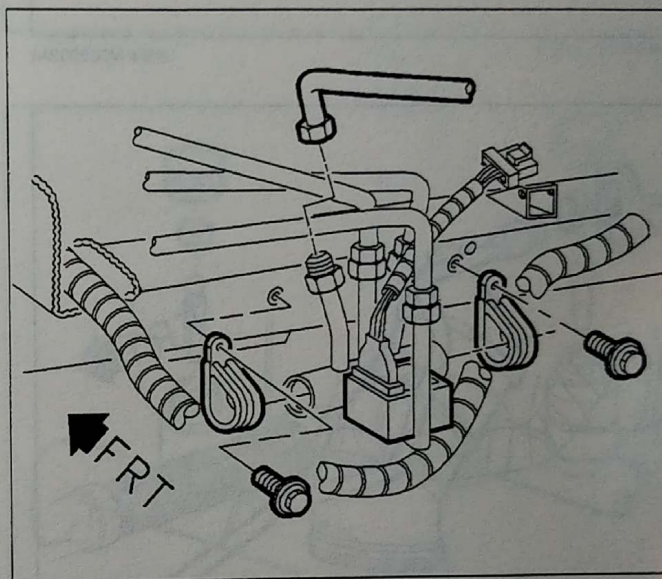
13. Install engine compartment sight shield.

A/C CONDENSER TUBE ASSEMBLY REVERSING VALVE TO EVAPORATOR REMOVAL

1. Place keypad in "lock" mode.
2. Remove engine compartment sight shield.
3. Recover refrigerant using an approved refrigerant recovery system.
4. Verify charge coupler is not installed in charger receptacle.
5. Remove power electronics bay. (Refer to "Power Electronics Bay" removal procedure in this service manual.)

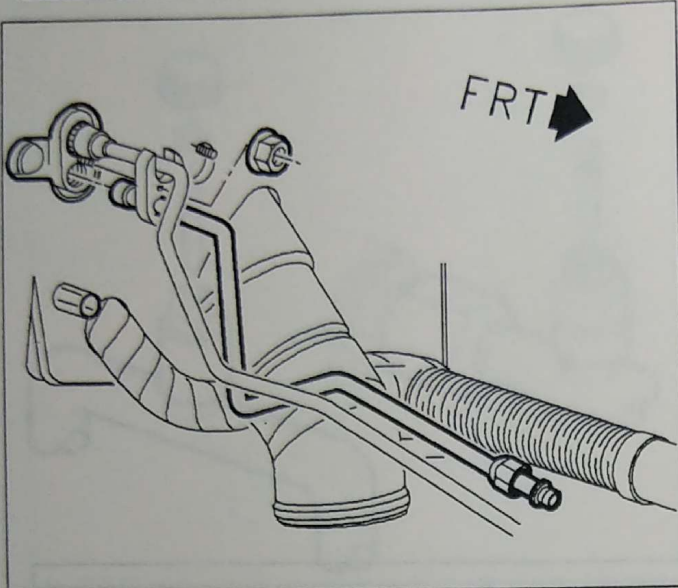
NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

6. Disconnect condenser tube from reversing valve.



PSMHVC67385AA

7. Remove nut retaining tubes at front of dash.
8. Disconnect evaporator tube from evaporator.



PSMHVC66802AA

9. Disconnect condenser tube from evaporator.
10. Remove condenser tube from vehicle.

INSTALLATION

1. Remove protective cover from evaporator fitting of condenser tube.

NOTICE: Use only R-12 Refrigerant oil (mineral) to lubricate O-rings. Use of R-134a (PAG) oil or R-134a heat pump (Ester) oil will cause premature corrosion of fitting joints.

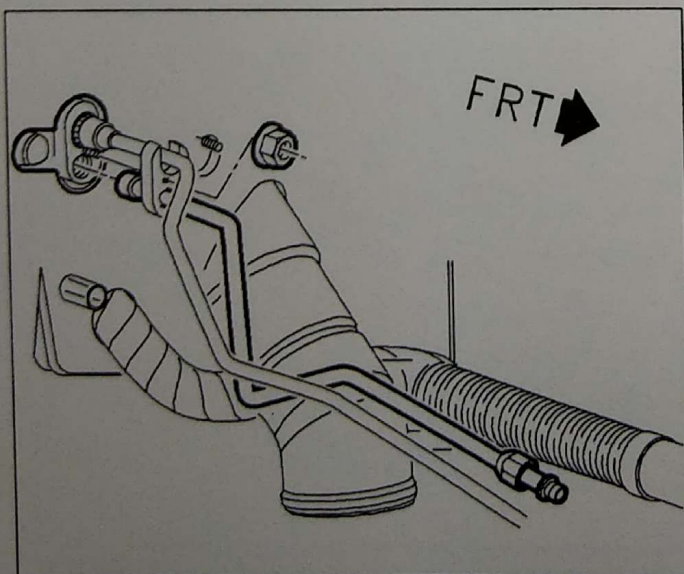
2. Lubricate O-ring with R-12 mineral refrigerant oil.
3. Position condenser tube in vehicle.
4. Connect condenser tube to evaporator.

5. Remove O-ring from evaporator tube and install a new genuine electric vehicle approved service replacement O-ring.

NOTICE: Use only R-12 Refrigerant oil (mineral) to lubricate O-rings. Use of R-134a (PAG) oil or R-134a heat pump (Ester) oil will cause premature corrosion of fitting joints.

6. Lubricate O-ring with R-12 mineral refrigerant oil.
7. Connect evaporator tube to evaporator.
8. Install evaporator tube nut and tighten.

Torque: 16 N•m (12 ft–lbs)



PSMHVC66802AA

9. Remove protective cover from reversing valve fitting of condenser tube.

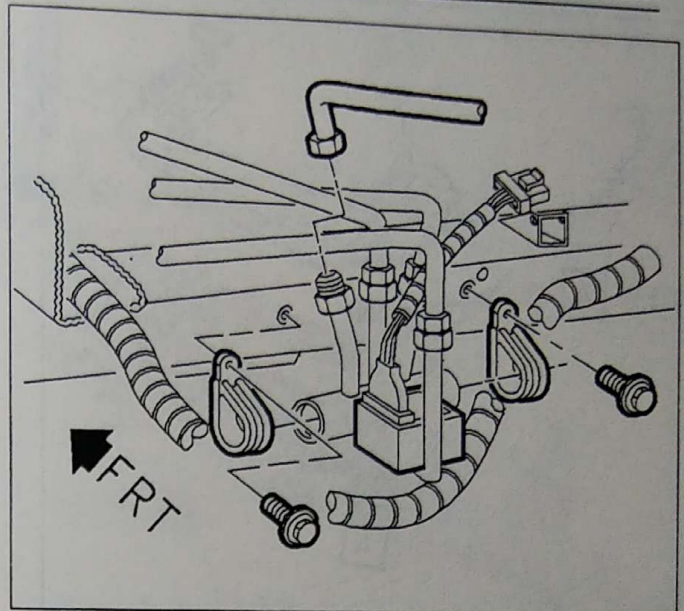
NOTICE: Use only R-12 Refrigerant oil (mineral) to lubricate O-rings. Use of R-134a (PAG) oil or R-134a heat pump (Ester) oil will cause premature corrosion of fitting joints.

10. Lubricate O-ring with R-12 mineral refrigerant oil.

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

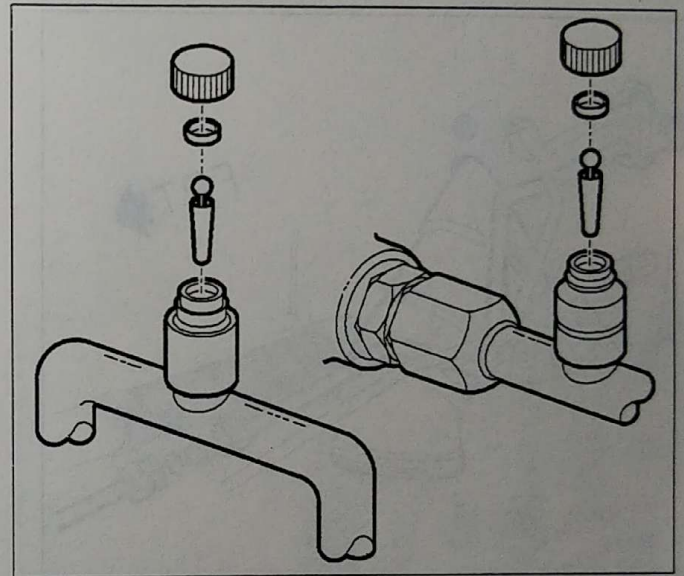
11. Connect condenser tube to reversing valve.

Torque: 20 N•m (15 ft-lbs)



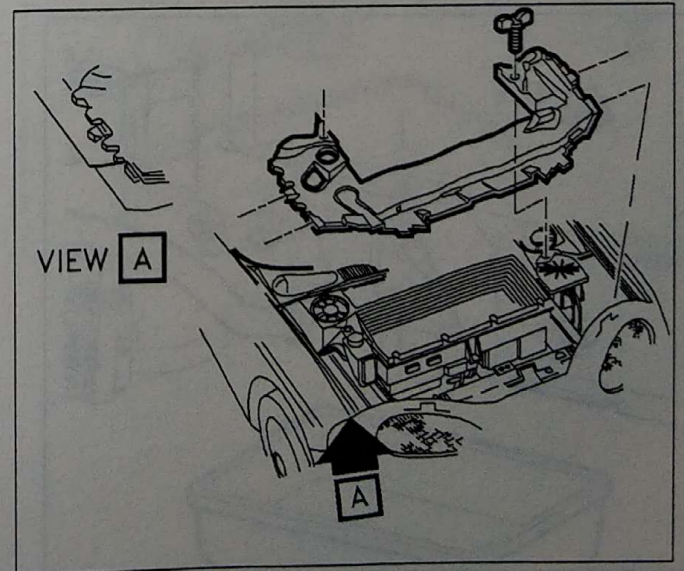
PSMHVC67385AA

12. Install new genuine electric vehicle approved service replacement heat pump schrader valves.
13. Evacuate, charge, and leak test heat pump system.
14. Install power electronics bay. (Refer to "Power Electronics Bay" installation procedure in this service manual.)
15. Verify heat pump system operation by performing system performance test.



PSMHVC66647AB

16. Install engine compartment sight shield.



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A/C REFRIGERANT ORIFICE TUBE ASSEMBLY

CONDENSER TO ORIFICE TUBE REMOVAL

1. Place keypad in "lock" mode.
2. Remove engine compartment sight shield.
3. Recover refrigerant using an approved refrigerant recovery system.
4. Verify charge coupler is not installed in charger receptacle.
5. Remove power electronics bay. (Refer to "Power Electronics Bay" removal procedure in this service manual.)

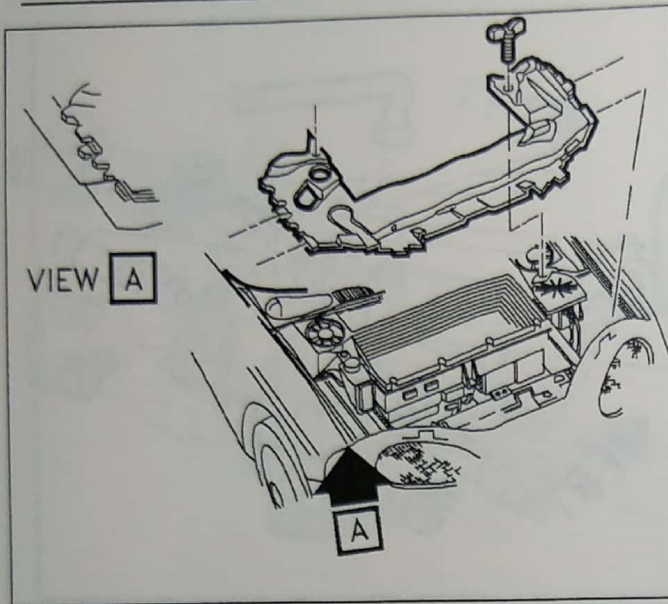
NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

6. Disconnect orifice tube at orifice tube fitting.
7. Raise vehicle on hoist.

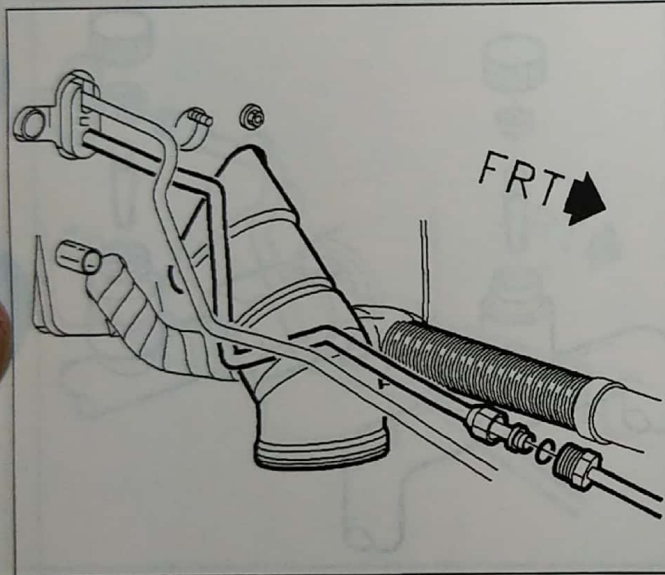
8. Disconnect the charger receptacle inlet hose from charger receptacle coolant valve.

IMPORTANT: Coolant will flow from both the hose and the valve fitting.

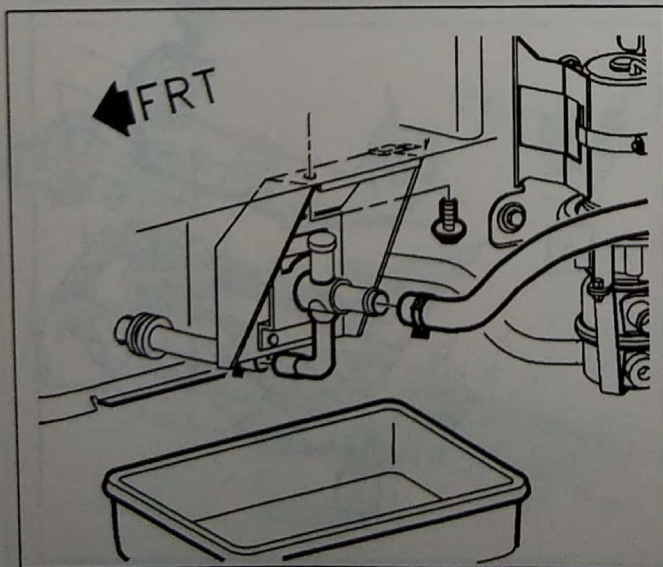
9. Remove fasteners retaining charger receptacle coolant valve, and position valve out of way.



PSMGEP65869AC



PSMHVC66995AA



PSMPEN66928AA

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

10. Disconnect orifice tube from lower condenser fitting.
11. Lower vehicle on hoist.
12. Remove orifice tube from vehicle.

INSTALLATION

1. Remove protective cover from condenser fitting of orifice tube.

NOTICE: Use only R-12 Refrigerant oil (mineral) to lubricate O-rings. Use of R-134a (PAG) oil or R-134a heat pump (Ester) oil will cause premature corrosion of fitting joints.

2. Lubricate O-ring with R-12 mineral refrigerant oil.
3. Position orifice tube in vehicle.
4. Raise vehicle on hoist.

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

5. Connect orifice tube to condenser lower fitting.

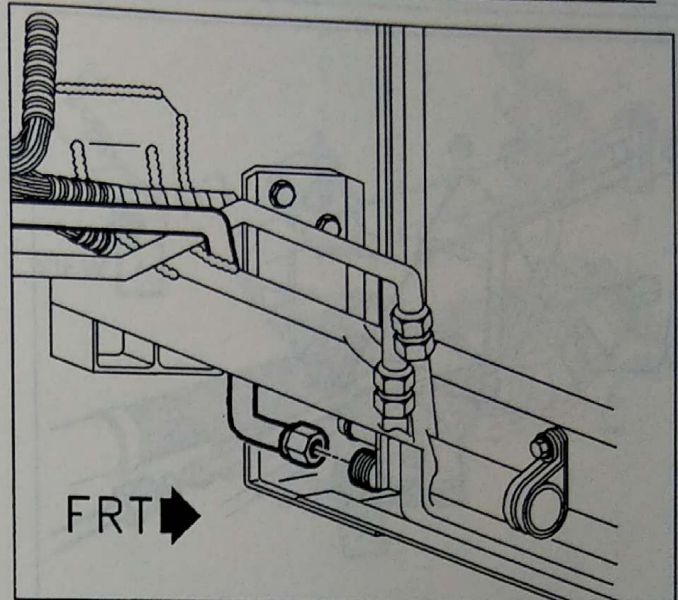
Torque: 20 N•m (15 ft–lbs)

6. Install charger receptacle valve tab into slot in left hand mid-rail, slide valve forward and install valve bolt.

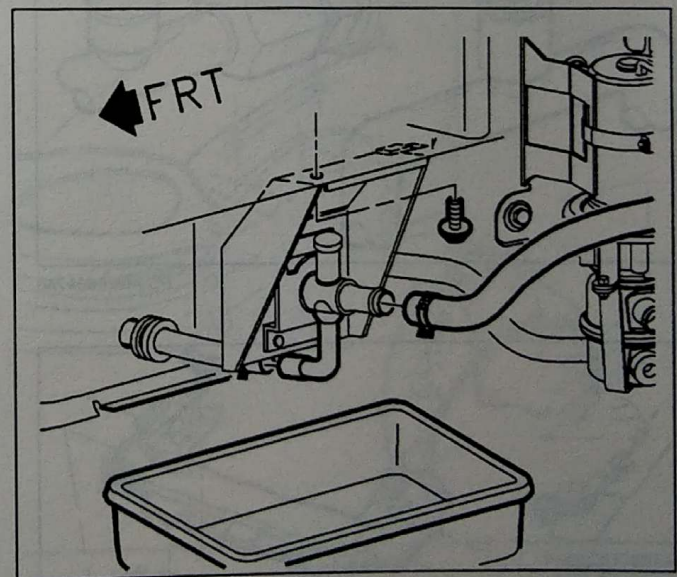
Torque: 10 N•m (7 ft–lbs)

7. Install charger receptacle inlet hose to charger receptacle coolant valve. Position clamp tangs to 6 o'clock.

8. Lower vehicle on hoist.



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9. Remove protective cover from orifice tube fitting of orifice tube.

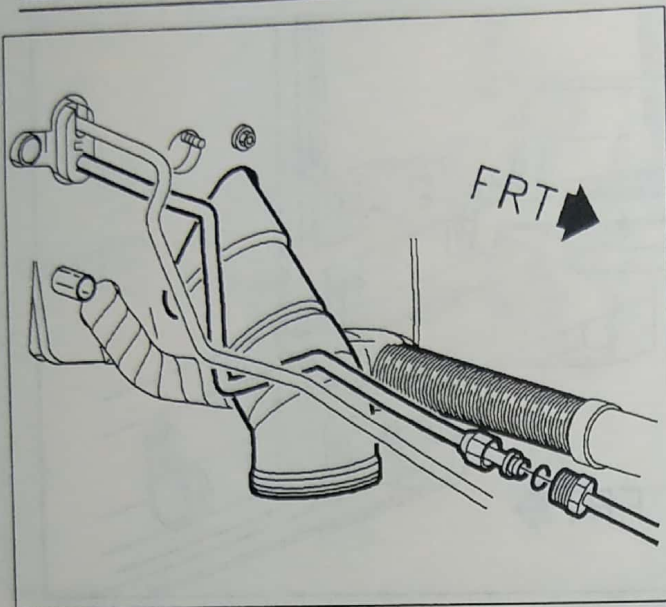
NOTICE: Use only R-12 Refrigerant oil (mineral) to lubricate O-rings. (Use of R-134a (PAG) oil or R-134a heat pump (Ester) oil will cause premature corrosion of fitting joints.)

10. Lubricate O-ring with R-12 mineral refrigerant oil.

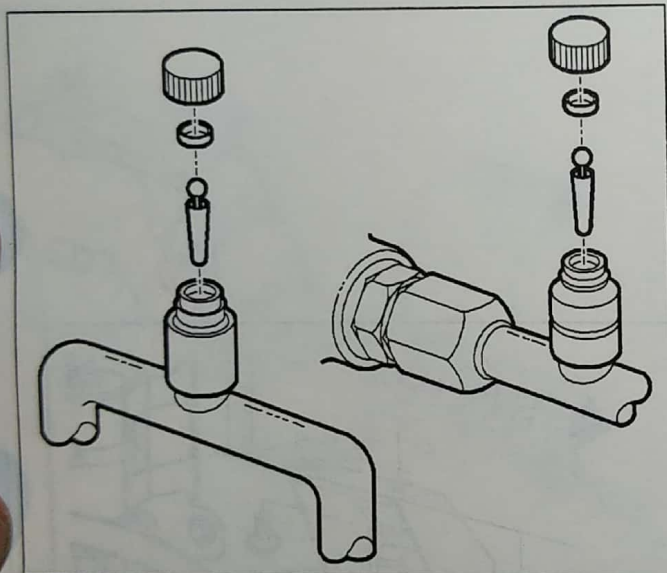
NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

11. Connect orifice tube to orifice tube fitting.

Torque: 20 N•m (15 ft–lbs)

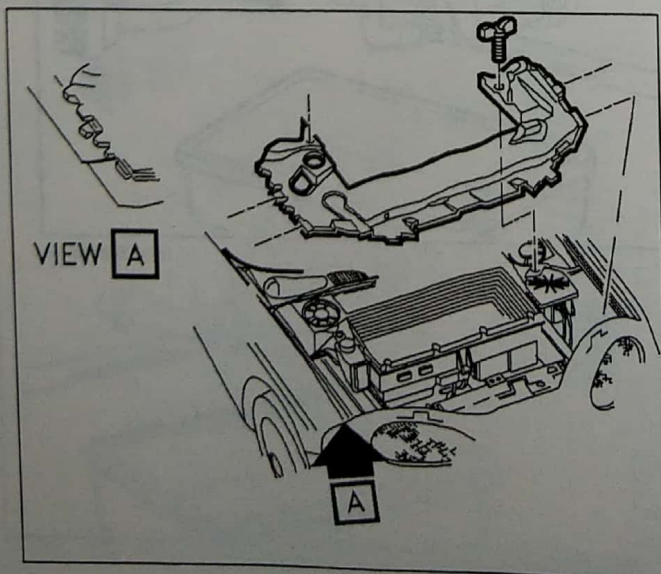


PSMHVC66995AA



PSMHVC66647AB

12. Install new genuine electric vehicle approved service replacement heat pump schrader valves.
13. Evacuate, charge, and leak test heat pump system.
14. Install power electronics bay. (Refer to "Power Electronics Bay" installation procedure in this service manual.)
15. Verify heat pump system operation by performing system performance test.



PSMGEP65869AC

16. Install engine compartment sight shield.

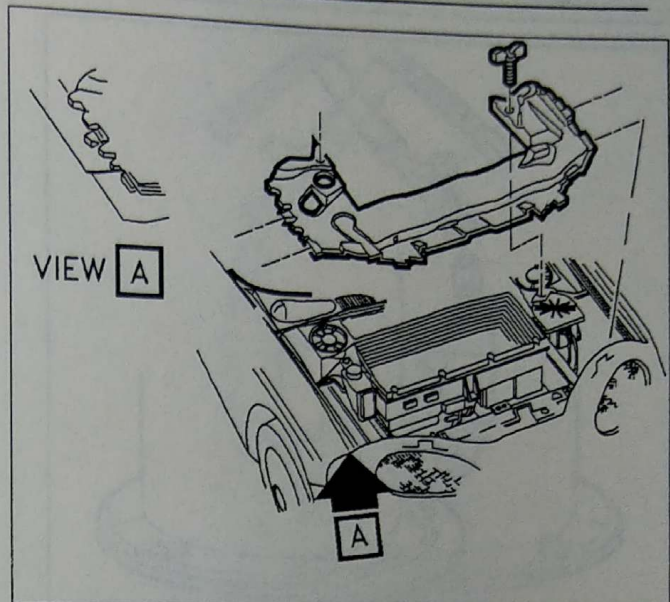
COMPRESSOR SUCTION TUBE ASSEMBLY

ACCUMULATOR TO COMPRESSOR REMOVAL

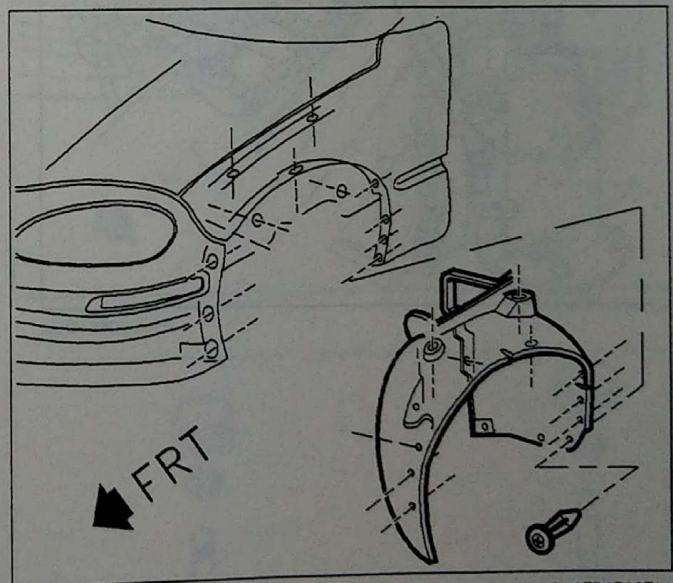
1. Place keypad in "lock" mode.
2. Remove engine compartment sight shield.
3. Recover refrigerent using an approved refrigerant recovery system.

CAUTION: TO REDUCE THE RISK OF SEVERE SHOCKS AND BURNS, THE HIGH VOLTAGE SYSTEM SHOULD BE DISABLED ANY TIME SERVICE WORK IS BEING PERFORMED ON OR AROUND THE HIGH VOLTAGE SYSTEM. WHEN IN DOUBT, ALWAYS DISABLE THE HIGH VOLTAGE SYSTEM. THE 12 VOLT SYSTEM WILL STILL BE ACTIVE AFTER THE HIGH VOLTAGE SYSTEM HAS BEEN DISABLED.

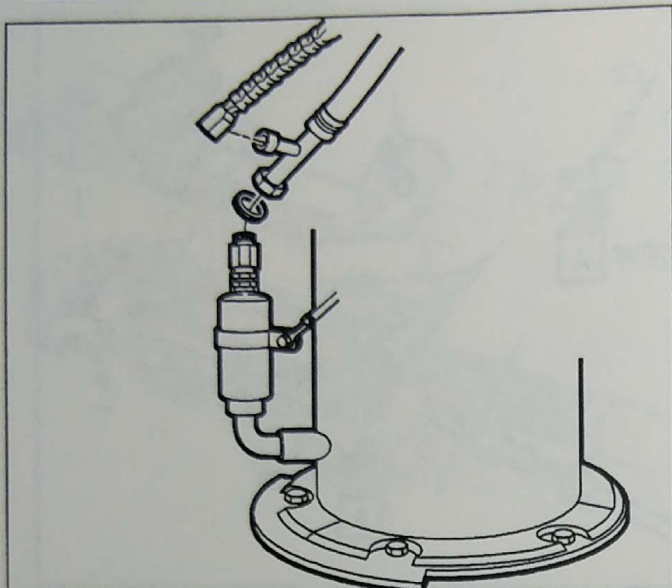
4. Disable high voltage. (Refer to "High Voltage Disable" procedure in this manual.)
5. Verify charge coupler is not installed in charger receptacle.
6. Raise vehicle on hoist. (Refer to "Lifting and Jacking Support Points" in this service manual.)
7. Remove left front wheel house liner.



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PSMGEP67687AA

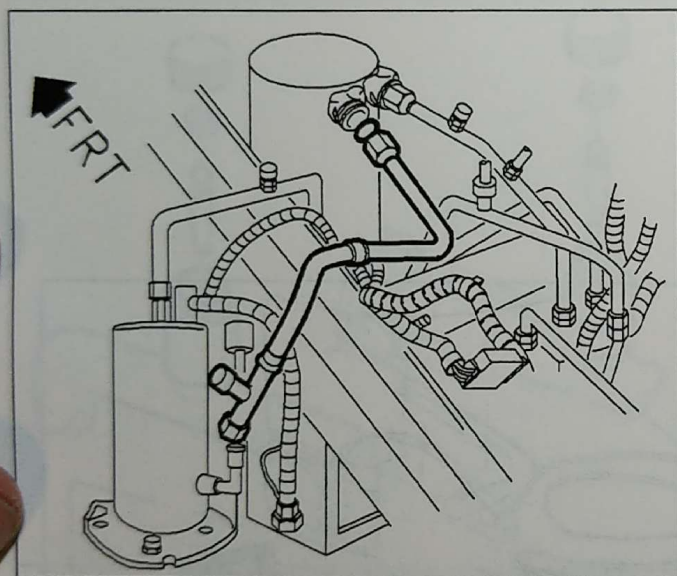


PSMHVC66497AA

8. Disconnect low pressure transducer electrical connector.

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

9. Disconnect suction tube from heat pump compressor.
10. Lower vehicle on lift.



PSMHVC66498AA

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

11. Disconnect suction tube from accumulator.
12. Remove suction tube from vehicle.

INSTALLATION

1. Remove protective cover from accumulator fitting of suction tube.

NOTICE: Use only R-12 Refrigerant oil (mineral) to lubricate O-rings. Use of R-134a (PAG) oil or R-134a heat pump (Ester) oil will cause premature corrosion of fitting joints.

2. Lubricate O-ring with R-12 mineral refrigerant oil.
3. Position suction tube in vehicle. Route tube over the left side mid-rail and under the compressor wire and connector.

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

4. Connect suction tube to accumulator.

Torque: 20 N•m (15 ft-lbs)

5. Raise vehicle on hoist.

6. Remove protective cover from compressor fitting of suction tube.

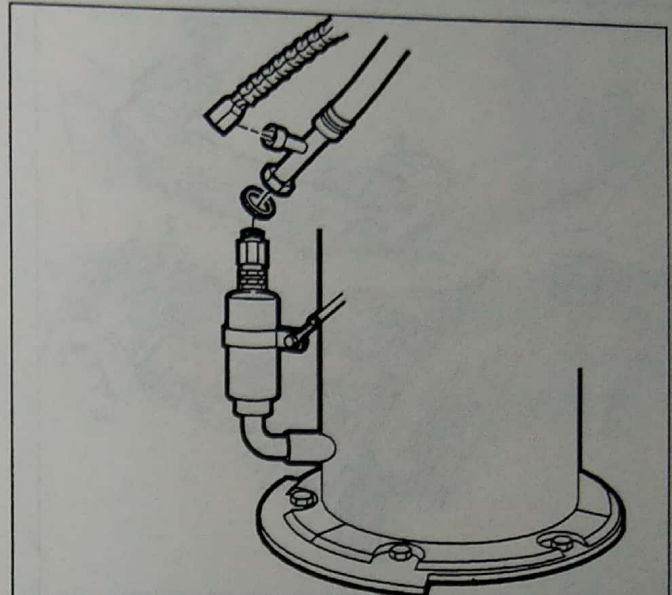
NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

NOTICE: Use only R-12 Refrigerant oil (mineral) to lubricate O-rings. Use of R-134a (PAG) oil or R-134a heat pump (Ester) oil will cause premature corrosion of fittings joints.

7. Lubricate O-ring with R-12 mineral refrigerant oil.
8. Connect suction tube to compressor.

Torque: 20 N•m (15 ft-lbs)

9. Connect low pressure transducer electrical connector.



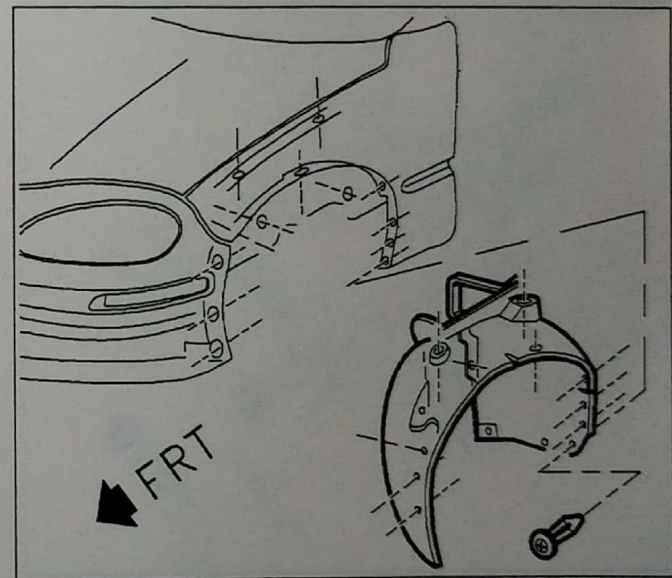
PSMHVC66497AA

10. Install left front wheel house liner.

Torque: 6 N•m (53 in-lbs)

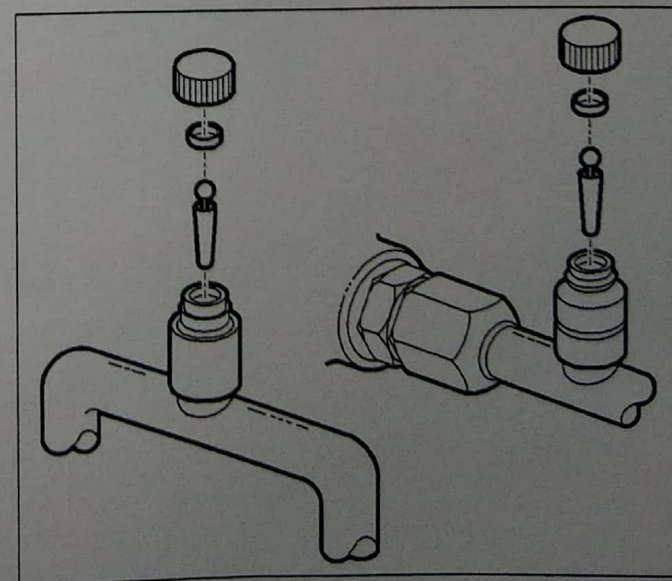
11. Lower vehicle on lift.

12. Enable high voltage. (Refer to "High Voltage Enable" procedure in this manual.)

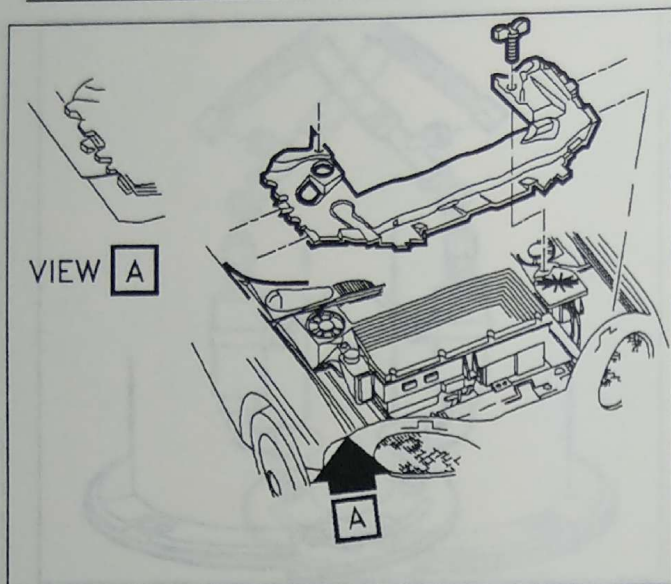


PSMGEP67687AA

13. Install new Electric Vehicle approved service replacement heat pump schrader valves.
14. Evacuate, charge, and leak test heat pump system.
15. Verify heat pump system operation by performing system performance test.



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PSMGEP65869AC

16. Install engine compartment sight shield.



REFRIGERANT REVERSING VALVE TUBE ASSEMBLY (DISCHARGE TUBE)

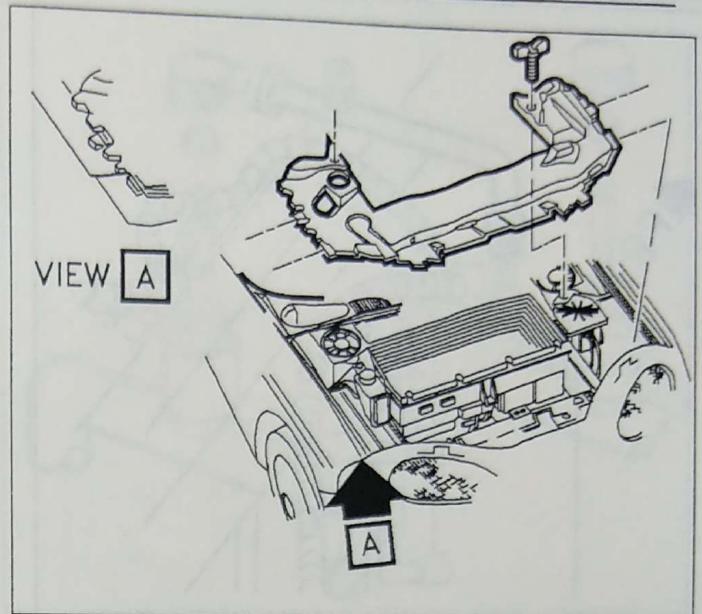
REVERSING VALVE TO COMPRESSOR

REMOVAL

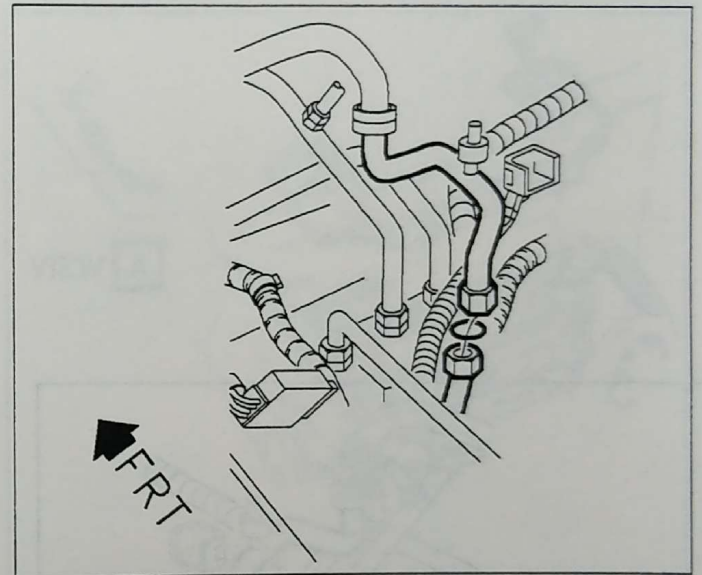
1. Place keypad in "lock" mode.
2. Remove engine compartment sight shield.
3. Recover refrigerant using an approved refrigerant recovery system.
4. Verify charge coupler is not installed in charger receptacle.
5. Remove power electronics bay. (Refer to "Power Electronics Bay" removal procedure in this manual.)

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

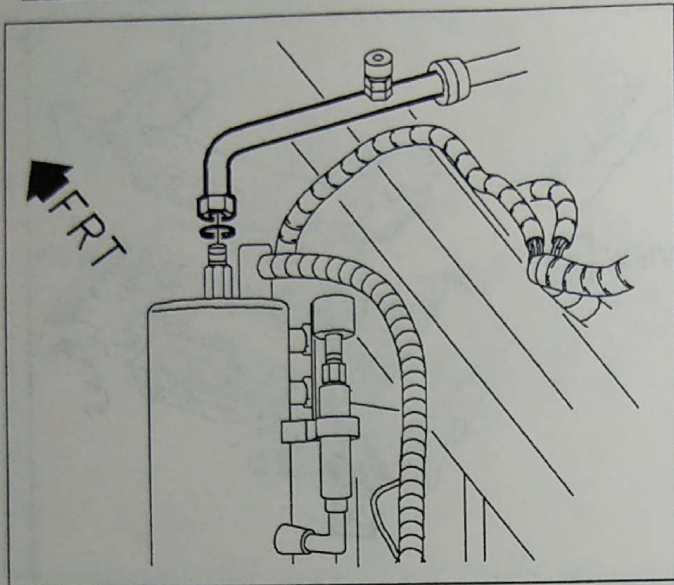
6. Disconnect reversing valve tube from reversing valve.
7. Disconnect high pressure transducer connector.



PSMGEP65869AC



PSMHVC66500AA



PSMHVC66499AA

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

8. Disconnect reversing valve tube from heat pump compressor.
9. Remove reversing valve tube from vehicle.

INSTALLATION

1. Remove protective cover from compressor fitting of reversing valve tube.

NOTICE: Use only R-12 Refrigerant oil (mineral) to lubricate O-rings. Use of R-134a (PAG) oil or R-134a heat pump (Ester) oil will cause premature corrosion of fitting joints.

2. Lubricate O-ring with R-12 mineral refrigerant oil.
3. Position reversing valve tube in vehicle.

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

4. Connect reversing valve tube to heat pump compressor.

Torque: 20 N•m (15 ft–lbs)

5. Remove protective cover from reversing valve fitting of reversing valve tube.

NOTICE: Use only R-12 Refrigerant oil (mineral) to lubricate O-rings. Use of R-134a (PAG) oil or R-134a heat pump (Ester) oil will cause premature corrosion of fitting joints.

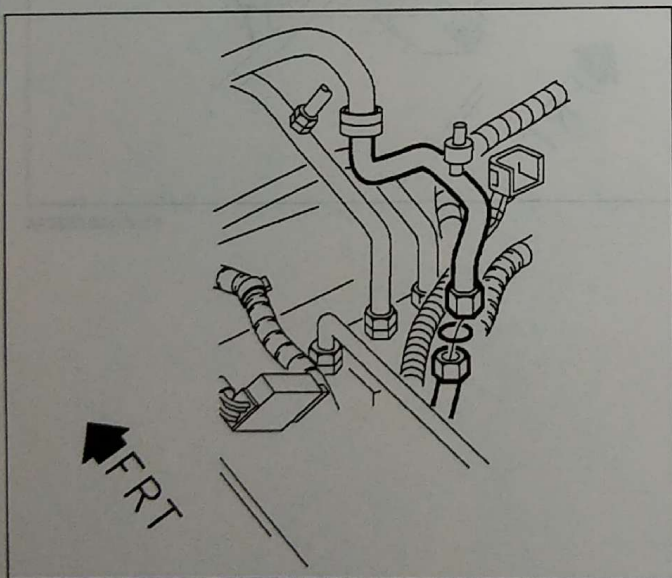
6. Lubricate O-ring with R-12 mineral refrigerant oil.

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

7. Connect reversing valve tube to reversing valve.

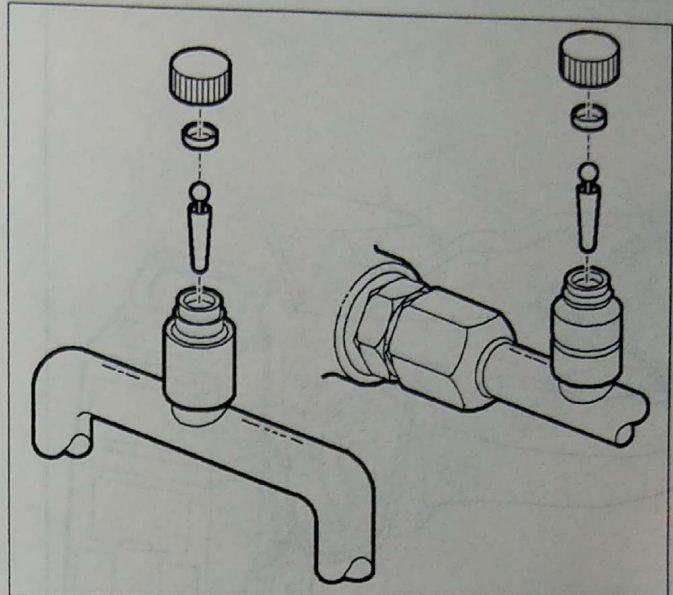
Torque: 20 N•m (15 ft–lbs)

8. Connect high pressure transducer connector.



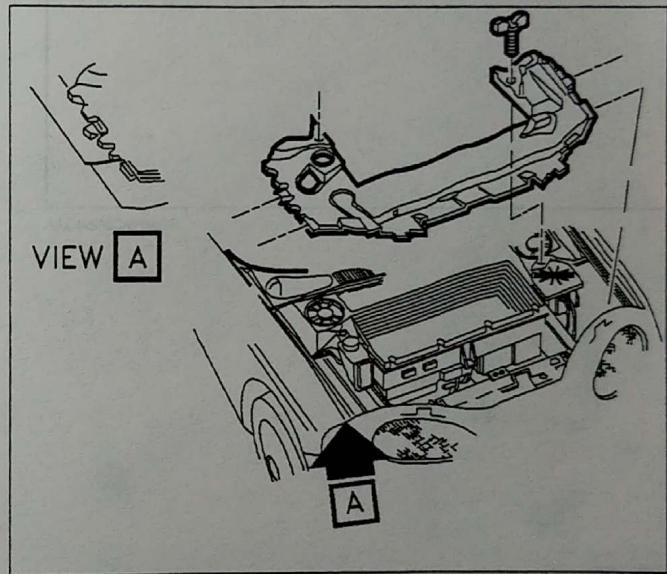
PSMHVC66500AA

9. Install new Electric Vehicle approved service replacement heat pump schrader valves.
10. Evacuate, charge, and leak test heat pump system.
11. Install power electronics bay. (Refer to "Power Electronics Bay" installation procedure in this manual.)
12. Verify heat pump system operation by performing system performance test.



PSMHVC66647AB

13. Install engine compartment sight shield.



PSMGEP65869AC

COMPRESSOR INFORMATION

COMPRESSOR

REMOVAL

NOTICE: When servicing the compressor, keep dirt and foreign material from getting on or into the compressor parts or system. Clean tools and a clean work area are important for proper service. The compressor connections and the outside of the compressor should be cleaned before any on car repairs, or before removal of the compressor. The parts must be kept clean at all times and any parts to be assembled should be cleaned with a non-petroleum base solvent and dried with air. Use only lint free cloths to wipe parts. Do not allow solvent to enter compressor or lines.

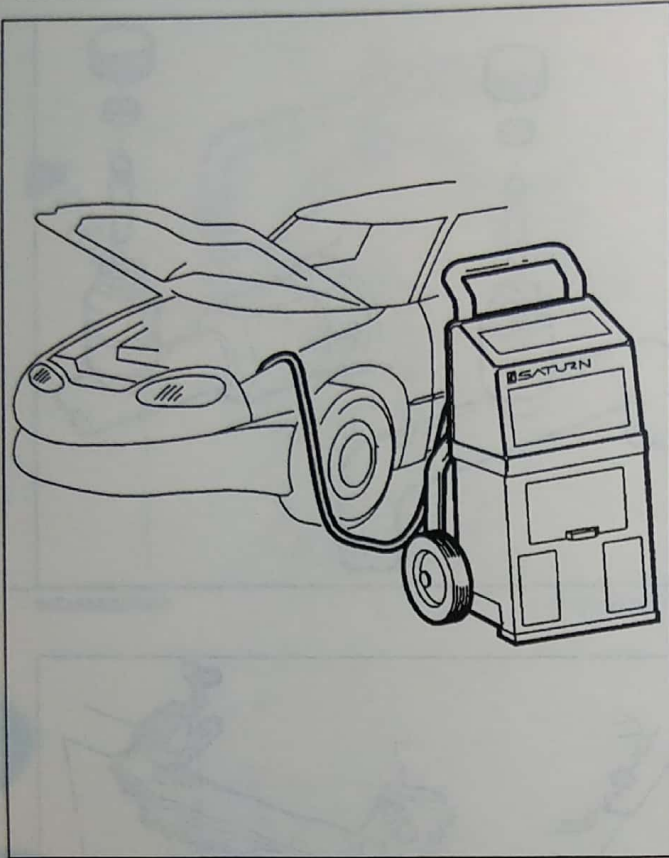
1. Place keypad in "lock" mode.
2. Remove engine compartment sight shield.
3. Recover refrigerant using an approved refrigerant recovery system.
4. Measure the amount of oil lost during recovery and record.

IMPORTANT: Add the recorded amount of new Electric Vehicle Ester compressor oil before charging the system.

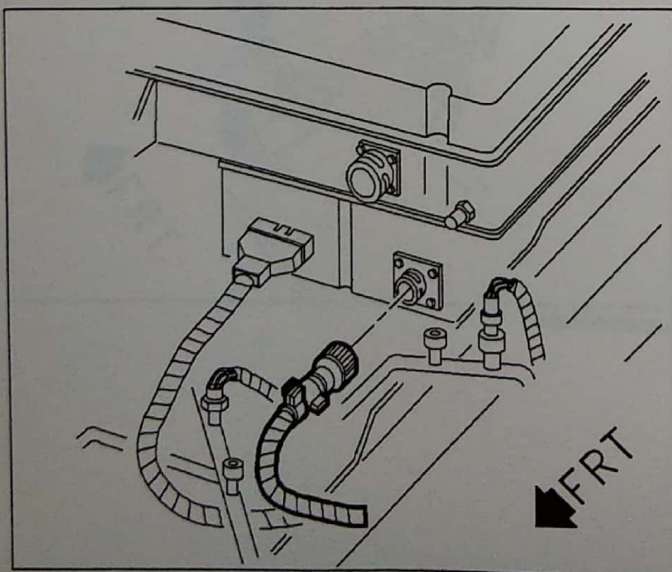
5. Verify charge coupler is not installed in charger receptacle.

CAUTION: TO REDUCE THE RISK OF SEVERE SHOCKS AND BURNS, THE HIGH VOLTAGE SYSTEM SHOULD BE DISABLED ANY TIME SERVICE WORK IS BEING PERFORMED ON OR AROUND THE HIGH VOLTAGE SYSTEM. WHEN IN DOUBT, ALWAYS DISABLE THE HIGH VOLTAGE SYSTEM. THE 12 VOLT SYSTEM WILL STILL BE ACTIVE AFTER THE HIGH VOLTAGE SYSTEM HAS BEEN DISABLED.

6. Disable high voltage. (Refer to "High Voltage Disable" procedure in this manual.)
7. Disconnect compressor electrical cannon connector from PIM.

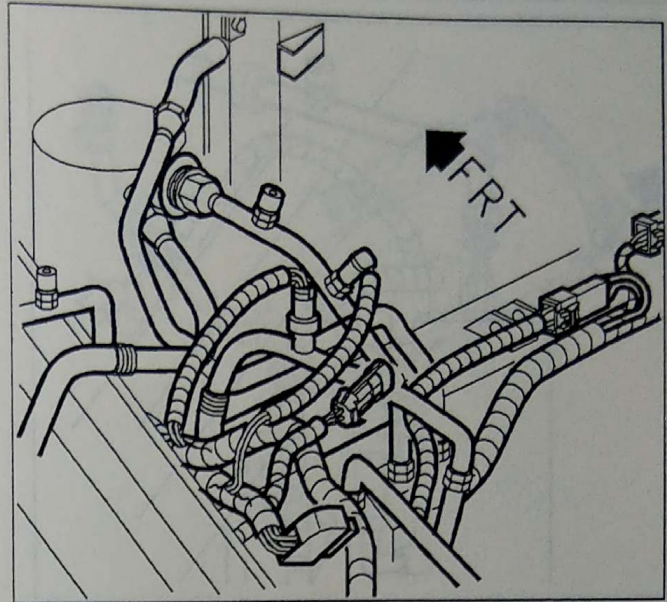


PSMHVC66645AA



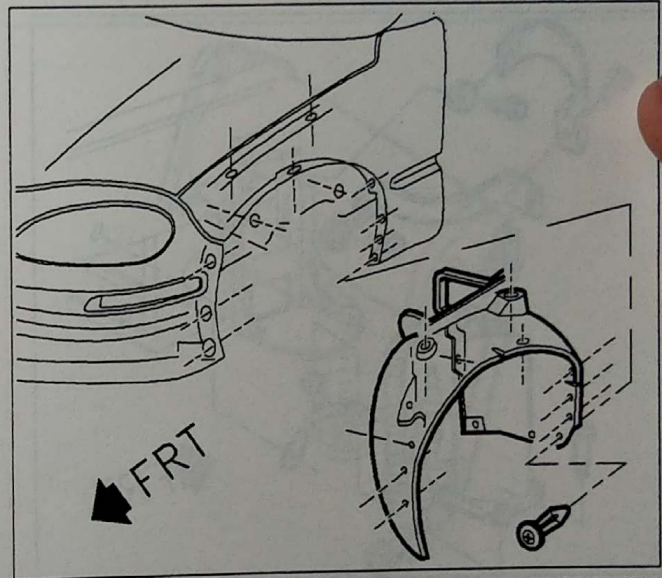
PSMHVC6738BA

8. Disconnect ground sensing harness connector.
9. Raise vehicle on hoist. (Refer to "Lifting and Jacking Support Points" in this manual.)



PSMHVC68318AA

10. Remove left front wheel house liner.

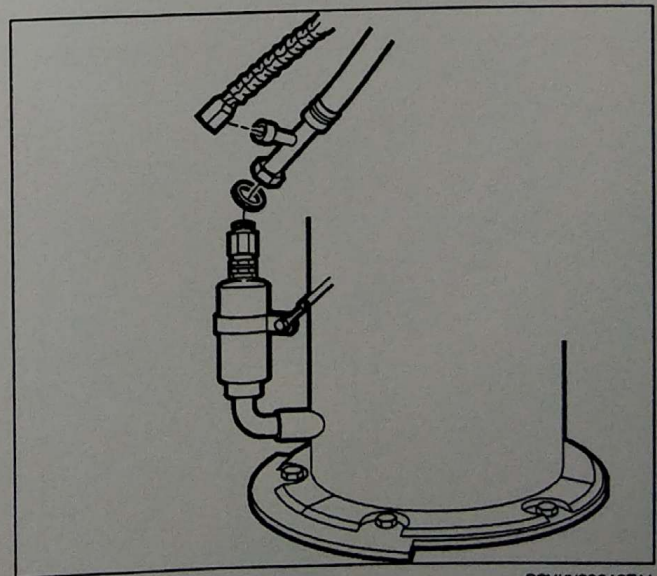


PSMGEP67687AA

11. Disconnect low pressure transducer electrical connector.

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

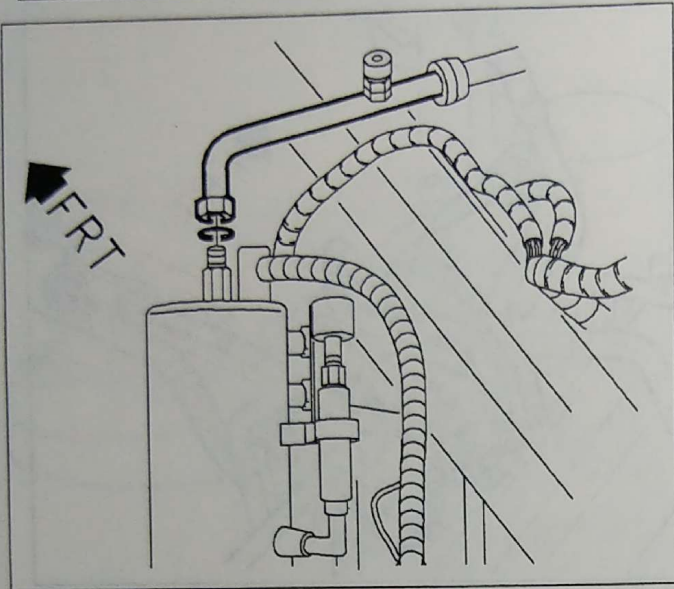
12. Disconnect suction tube from heat pump compressor.
13. Install plastic bag on the open end of suction tube.



PSMHVC66497AA

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

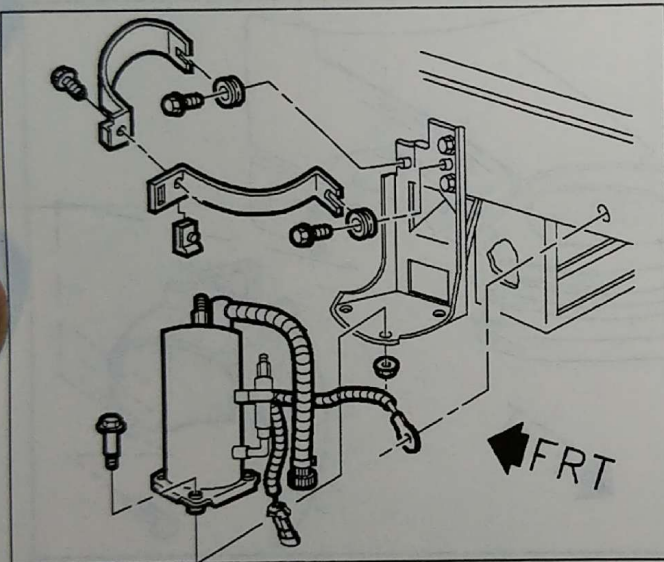
14. Disconnect reversing valve tube from heat pump compressor.
15. Install plastic bag on the open end of reversing valve tube.



PSMHVC66499AA

16. Remove ground strap bolt from left front mid rail.
17. Remove compressor band bracket bolt.
18. Remove compressor to mounting bracket bolts and nuts.
19. Remove compressor band bracket from compressor mounting bracket by sliding band bracket forward on insulators.
20. Remove compressor from vehicle.

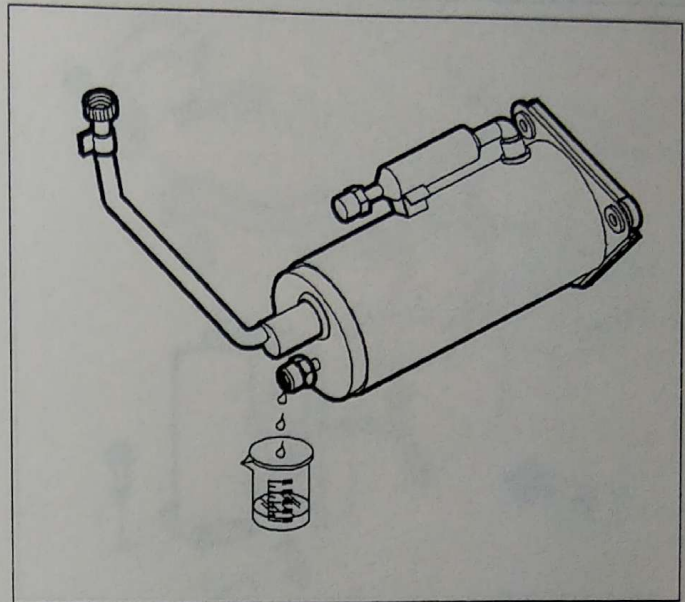
IMPORTANT: Keep compressor level during removal to avoid any oil loss from the compressor ports.



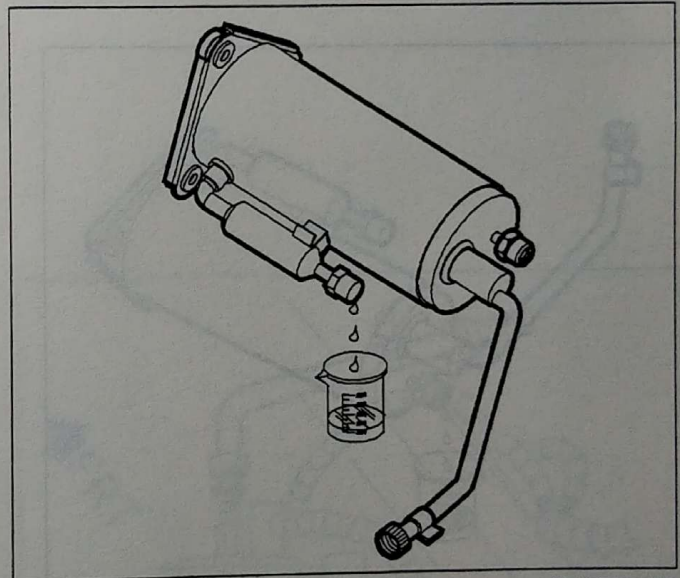
PSMHVC66804AB

COMPRESSOR OIL MEASUREMENT

1. Tip compressor with the low side port facing upward, then drain oil into a clean container from the high side port first.
2. Turn compressor over and drain oil from the low side.
3. Move the compressor to a different position to remove all the oil possible.
4. Turn the compressor back to the high side to redrain, then back to low side and redrain. Stop oil draining when the oil coming from the high and low side ports become only drops. Measure oil removed and record.
5. Discard removed oil as all replacement compressors come with 480 cc of new Electric Vehicle Ester compressor oil installed.



PSMHVC67389AA



PSMHVC67390AA

JUDGEMENT ON CONTAMINATION OF COMPRESSOR OIL

Unlike motor oil, no cleaning agent is added to the compressor oil. Even if the compressor is run for a long period of time the oil never breaks down as long as there is nothing wrong with the compressor or the heat pump system.

Inspect the extracted oil for any of the following conditions:

- Color change from clear to dark brown or black.
- Presence of foreign substances, metal filings, etc., in the oil.

When the oil extracted from the compressor is found as mentioned above, the accumulator must be replaced.

NOTICE: Failure to replace accumulator will result in damage to new compressor.

NEW COMPRESSOR INSTALLED OIL CHARGE

IMPORTANT: Service compressors are charged with 480 ml of Electric Vehicle Ester refrigerant oil.

1. With the compressor in the upright position, loosen high side cap slowly to release nitrogen (N_2) charge from compressor. Remove high and low side caps.

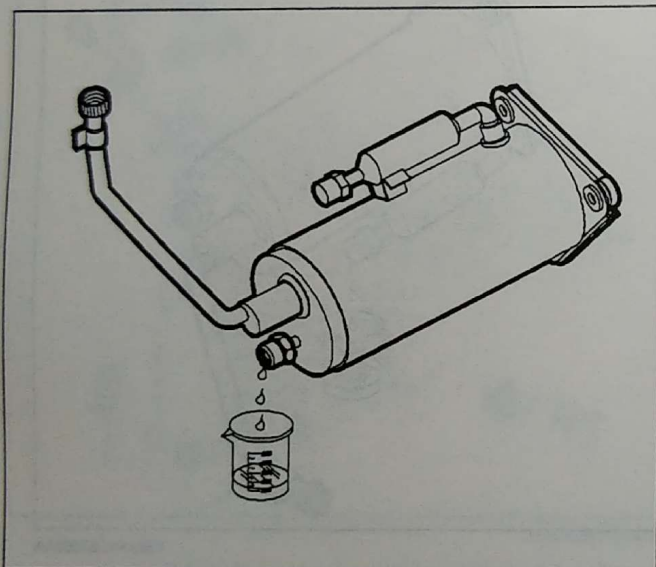
IMPORTANT: Take care not to let the oil escape.

2. Install caps on removed compressor.

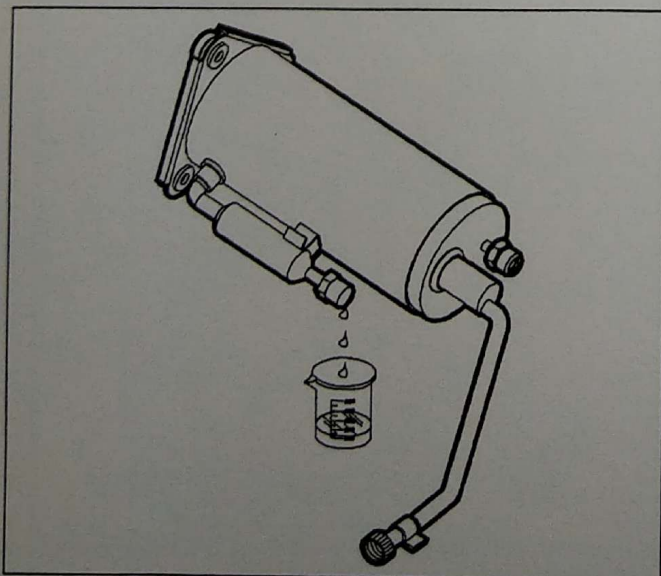
3. Drain new compressor as described in compressor oil measurement. There will be more oil that can be drained from the new compressor that has been charged with 480 ml than the compressor that was removed.

IMPORTANT: Oil drained from the new compressor can be installed if drained into a clean container.

4. Add the recorded amount of oil drained from the removed compressor. Also add the amount of oil lost during recovery. Add oil to the low pressure side of the new compressor. This will keep the same amount of oil in the heat pump system.



PSMHVC67389AA



PSMHVC67390AA

COMPRESSOR INSTALLATION

IMPORTANT: Keep compressor level during installation to avoid oil loss from the low or high side ports.

1. Position compressor on compressor mounting bracket. Make sure that the low side port is indexed to the rear of the car.
2. Install compressor band brackets onto insulators. Make sure that the band brackets are positioned in the center of the insulators.
3. Install compressor mounting bracket bolts and nuts.

Torque:

Tighten compressor mounting bracket bolt until the bolts don't move in the insulators. Do not over tighten these bolts this will cause excessive noise from the compressor if the isolators are crushed.

4. Position compressor band bracket on compressor body. Install compressor band bracket bolt.

Torque: 13 N•m (10 ft–lbs)

5. Install ground strap bolt to left mid-rail.

Torque: 10 N•m (89 in–lbs)

6. Remove O-ring from reversing valve tube fitting and install a new Electric Vehicle approved service replacement O-ring.

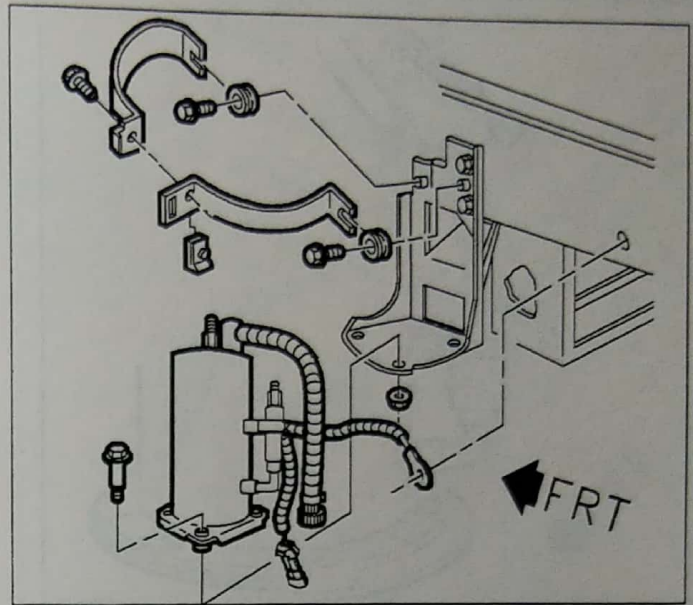
NOTICE: Use only R-12 Refrigerant oil (mineral) to lubricate O-rings. Use of R-134a (PAG) oil or R-134a heat pump (Ester) oil will cause premature corrosion of fitting joints.

7. Lubricate O-ring with R-12 mineral refrigerant oil.

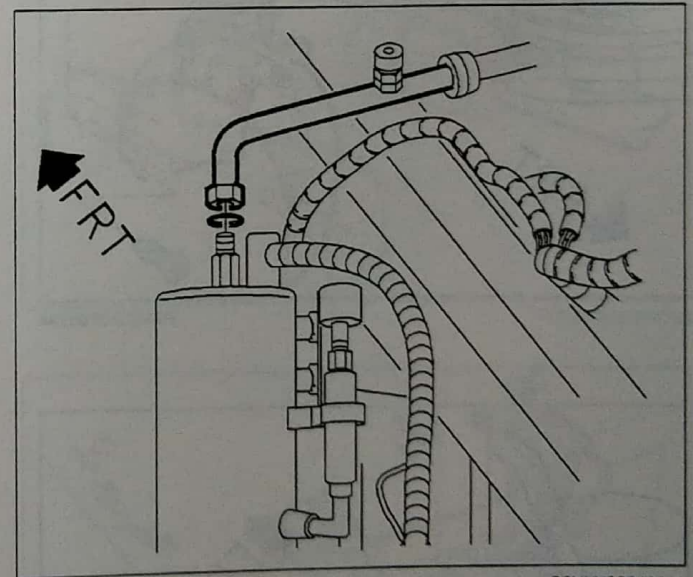
NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

8. Connect reversing valve tube to heat pump compressor.

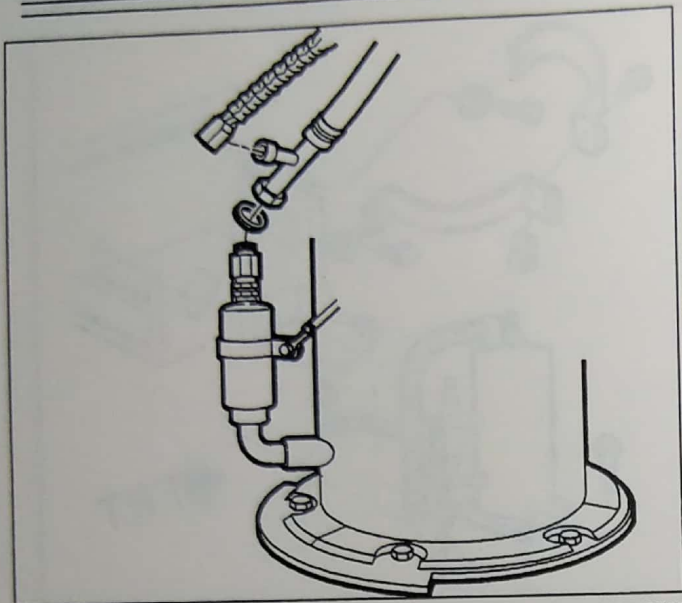
Torque: 20 N•m (15 ft–lbs)



PSMHVC66804A8



PSMHVC66499AA



9. Remove O-ring from suction tube fitting and install a new Electric Vehicle approved service replacement O-ring.

NOTICE: Use only R-12 Refrigerant oil (mineral) to lubricate O-rings. Use of R-134a (PAG) oil or R-134a heat pump (Ester) oil will cause premature corrosion of fitting joints.

10. Lubricate O-ring with R-12 mineral refrigerant oil.

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

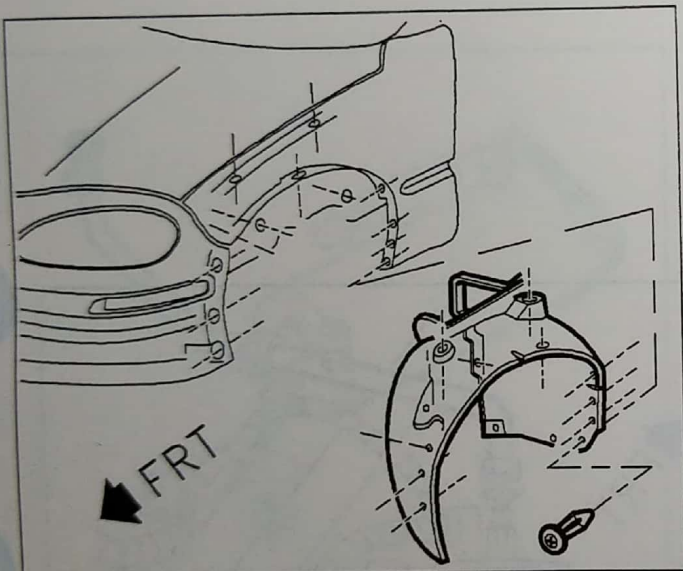
11. Connect suction tube to heat pump compressor.

Torque: 20 N•m (15 ft-lbs)

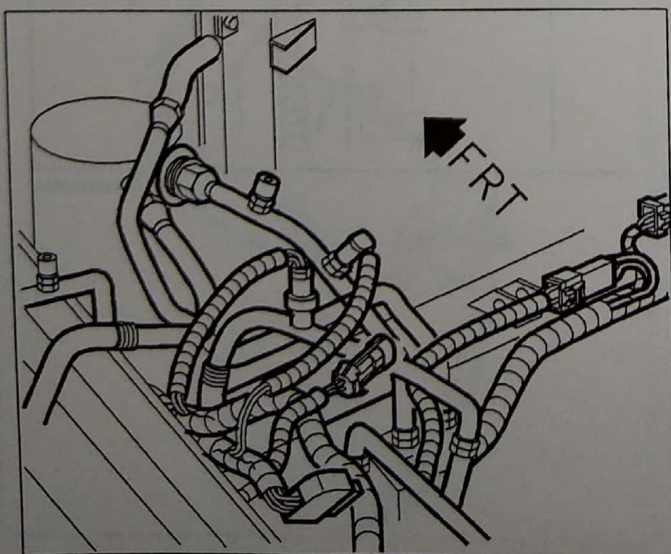
12. Connect low pressure transducer electrical connector.

13. Install left front wheel house liner.

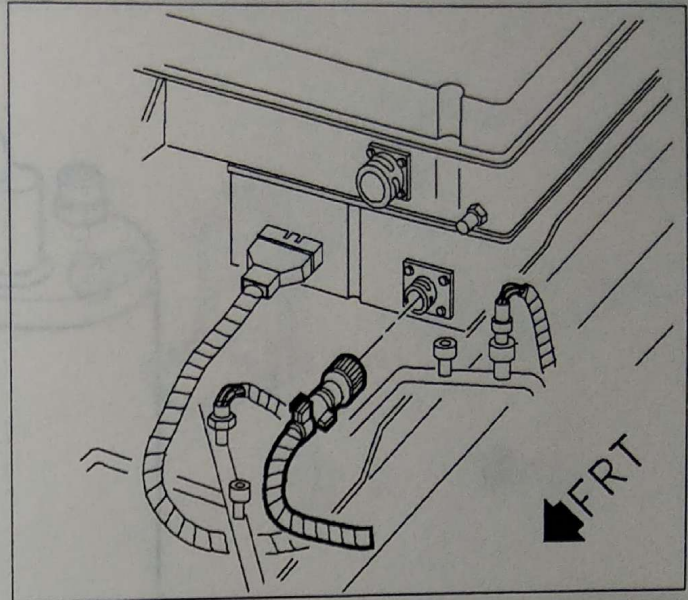
14. Lower vehicle on hoist.



15. Connect ground sensing harness connector.

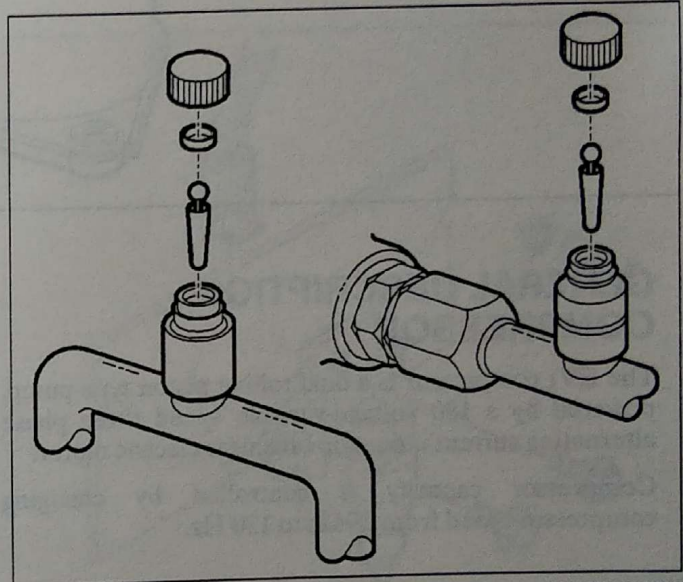


16. Connect compressor electrical cannon connector to PIM.
17. Enable high voltage. (Refer to "High Voltage Enable" procedure in this service manual.)



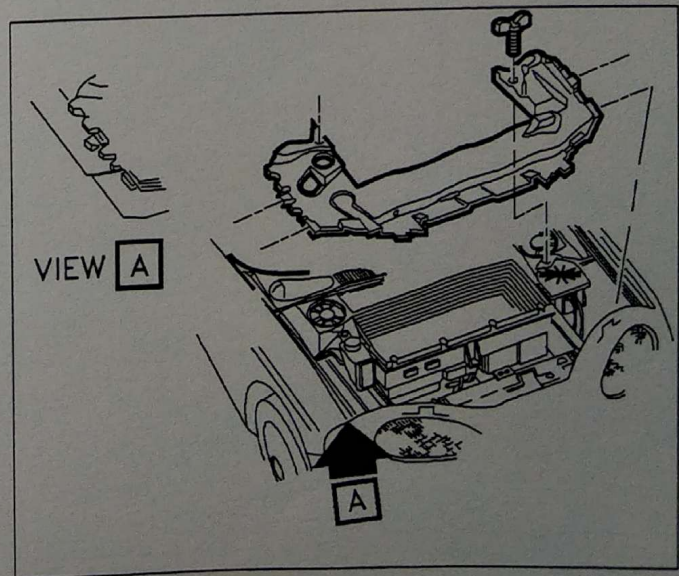
PSMHVC67388AA

18. Install new Electric Vehicle approved service replacement heat pump schrader valves.
19. Evacuate, charge, and leak test heat pump system.
20. Verify heat pump system operation by performing system performance test.

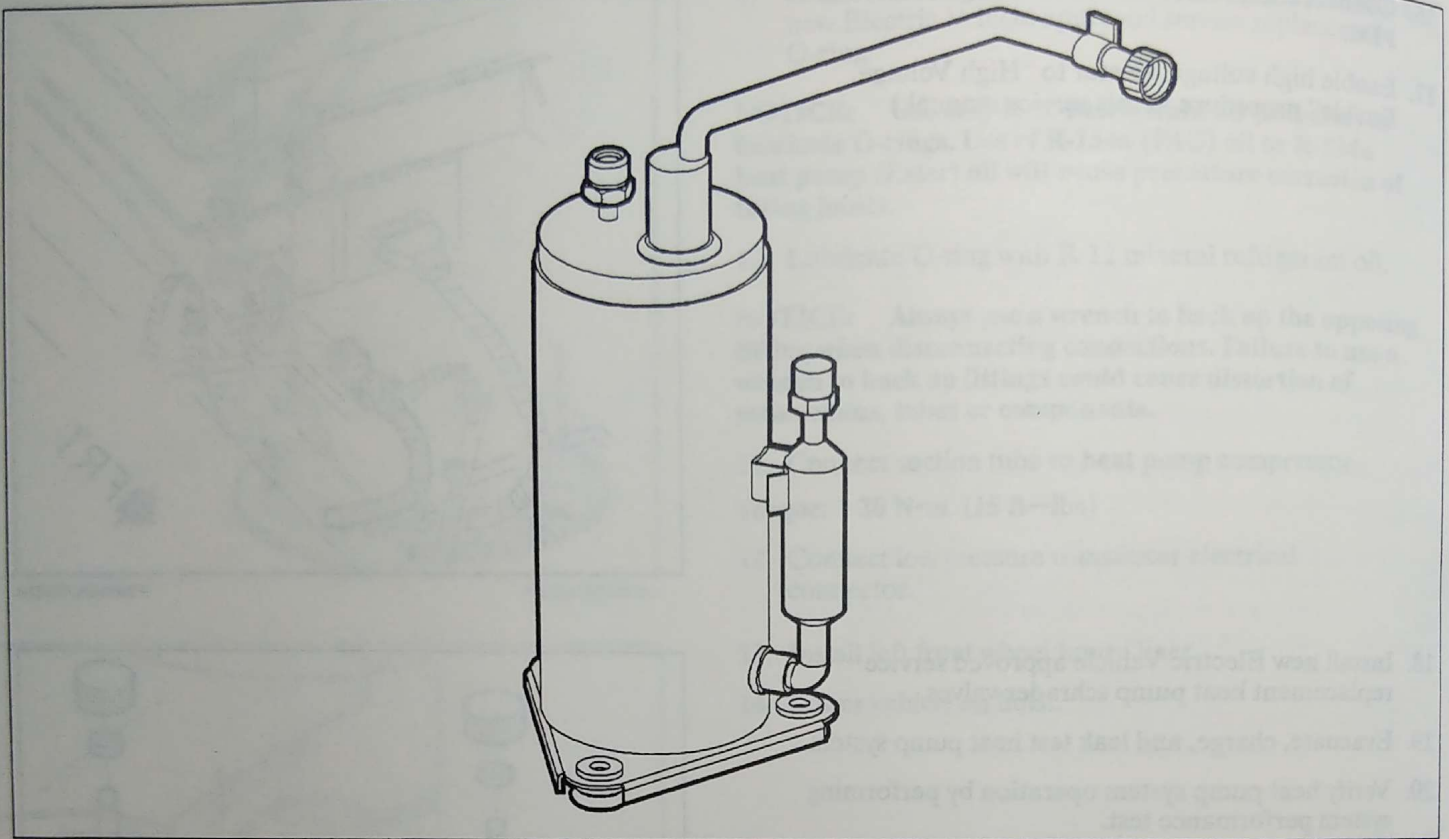


PSMHVC66647AB

21. Install engine compartment sight shield.



PSMGEP65869AC



PSMHVC67397AA

GENERAL DESCRIPTION COMPRESSOR

The EV1 compressor is a dual rolling piston type pump, powered by a 180 voltage-variable speed three phase alternating current induction brushless electric motor.

Compressor capacity is controlled by changing compressor speed from 25 Hz to 120 Hz.

The compressor displacement is 19 cc per revolution.

The compressor's main function is compress the low pressure refrigerant vapor from the accumulator into a high pressure, high temperature vapor.

COMPRESSOR MOUNTING BRACKET

REMOVAL

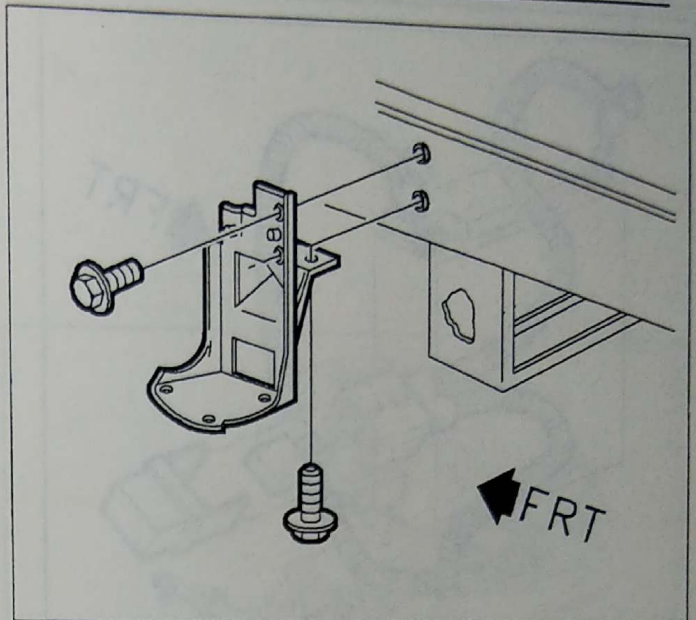
1. Remove compressor. (Refer to "Compressor Removal" procedure in this section.)
2. Remove fastener from compressor mounting bracket to mid-rail.

INSTALLATION

1. Position compressor mounting bracket to mid-rail aligning mid-rail insert nuts to bracket. Hand start fasteners into insert nuts. Tighten fasteners.

Torque: 33 N•m (24 ft-lbs)

2. Install compressor. (Refer to "Compressor Installation" procedure in this section.)



PSMHVC66998AA

OUTSIDE AIR TEMPERATURE SENSOR ASSEMBLY

The outside air temperature sensor is located on the front end panel right side of radiator opening.

REMOVAL

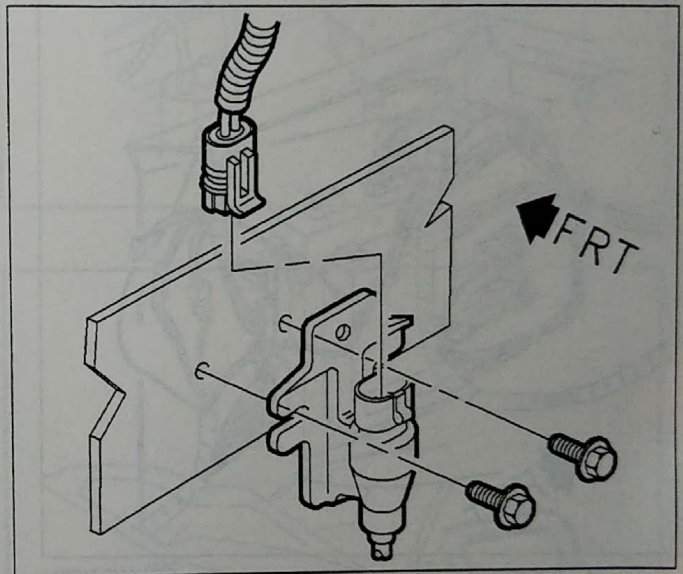
1. Disconnect outside air temperature sensor electrical connector.
2. Remove outside air temperature sensor screws.
3. Remove sensor from vehicle.

INSTALLATION

1. Position sensor to front end panel and install outside air temperature sensor screws.

Torque: 1.5 N•m (13 in-lbs)

2. Connect outside air temperature sensor electrical connector.



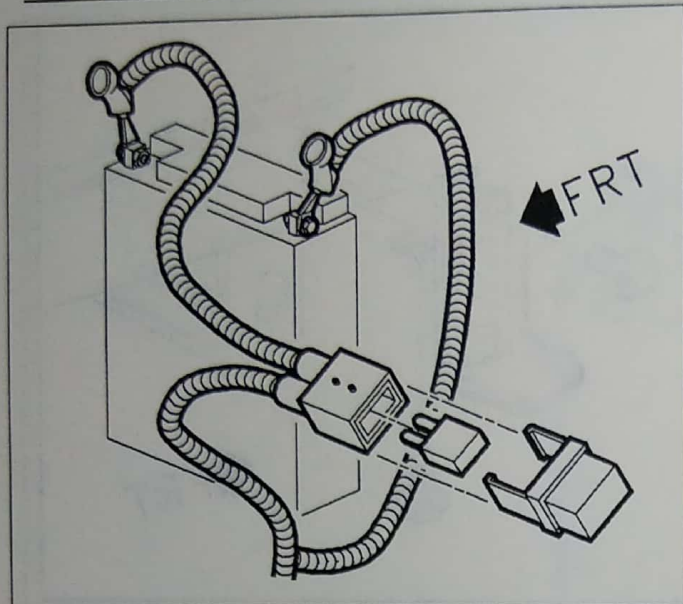
PSMPEN66660AA

HEAT PUMP VENTILATION SYSTEM/THERMAL CONTROL MODULE (HTCM)

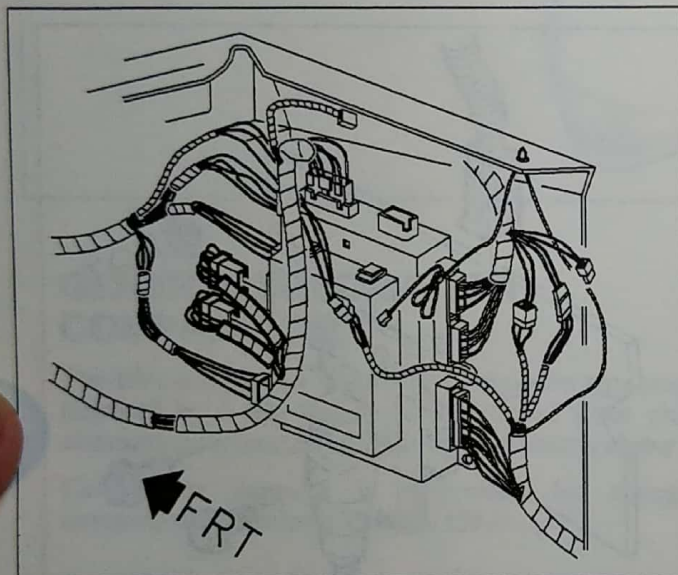
REMOVAL

1. Place key pad in "LOCK" mode.
2. Remove the negative auxiliary battery cable 60 amp maxi fuse, located on the right hand mid-rail.

The heat pump ventilation system/thermal control module (HTCM) is attached to the right hand junction block (RHJB) with four retainers.



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PSMHVC67422AA

NOTICE: Do not pull on connectors or wires to remove the HTCM. This could back out a terminal and cause an intermittent connection.

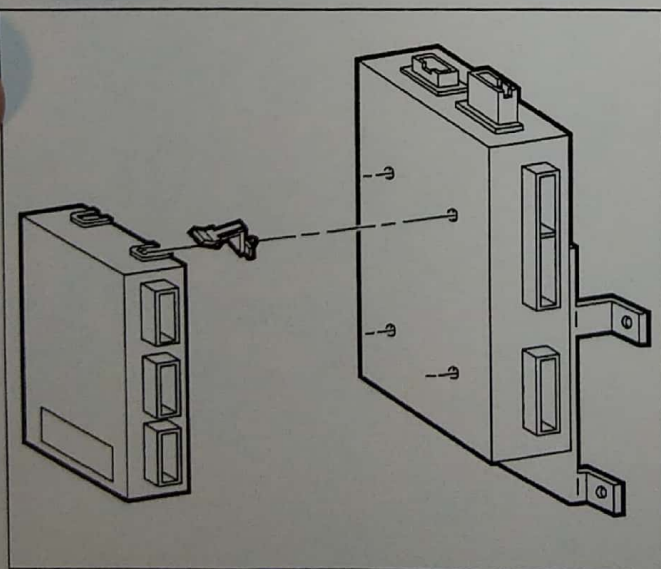
3. Release the four retainers securing the HTCM to RHJB and lift out.
4. Disconnect HTCM connectors.

INSTALLATION

1. Connect HTCM connectors.
2. Inspect HTCM retainers, replace retainers if bent or broken.

3. Align retainers and push the HTCM into position on the RHJB.
4. Install 60 amp maxi fuse for the auxiliary battery cable.

IMPORTANT: The HTCM performs an initialization test when the battery voltage is restored. Do not activate the heat pump system for one minute after restoring power.



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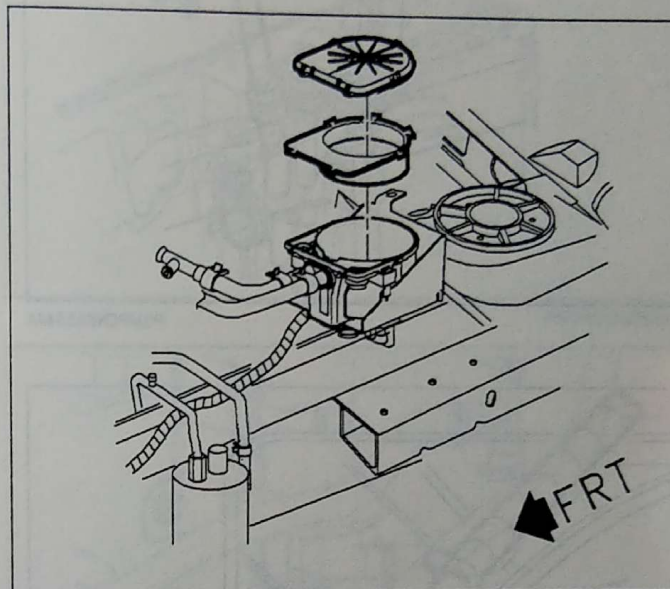
CONDENSER RADIATOR FAN MODULE ASSEMBLY (CRFM)

REMOVAL

1. Raise vehicle on hoist. (Refer to "Lifting and Jacking Support Points" in this manual.)

CAUTION: TO REDUCE THE RISK OF SEVERE SHOCKS AND BURNS, THE HIGH VOLTAGE SYSTEM SHOULD BE DISABLED ANY TIME SERVICE WORK IS BEING PERFORMED ON OR AROUND THE HIGH VOLTAGE SYSTEM. WHEN IN DOUBT, ALWAYS DISABLE THE HIGH VOLTAGE SYSTEM. THE 12 VOLT SYSTEM WILL STILL BE ACTIVE AFTER THE HIGH VOLTAGE SYSTEM HAS BEEN DISABLED.

2. Disable high voltage. (Refer to "High Voltage Disable" procedure in this manual.)
3. Remove expansion tank cover.



PSMPEN66720AA

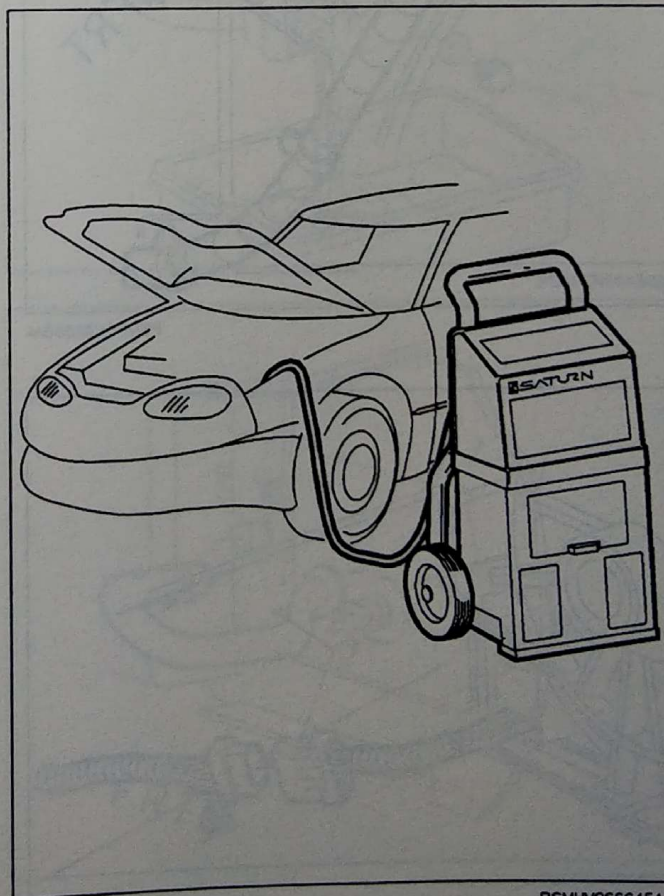
4. Recover R134—a refrigerant using an approved refrigerant recovery system.

Follow the manufacturers operating instruction for system being used.

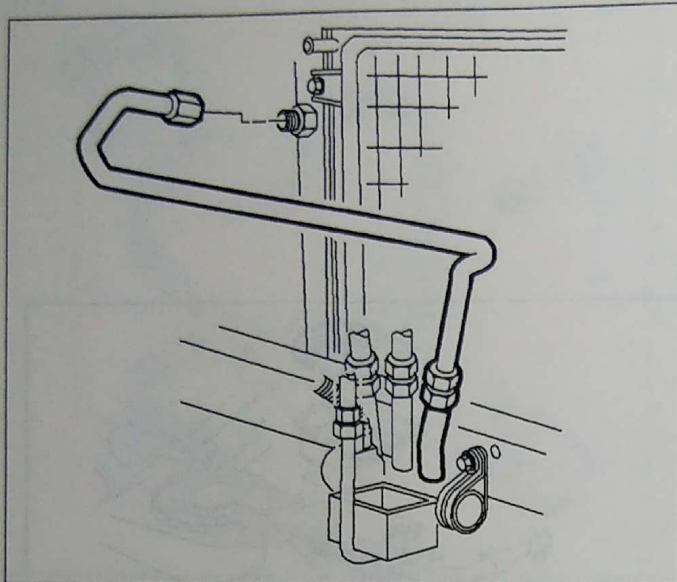
NOTICE: The air conditioning refrigerant and recycling station must meet UL standards for moisture and contamination removal. Recovery system which cannot meet these standards are not approved for warranty repairs. Reuse of moisture or particulate contaminated refrigerant will result in premature compressor and other component failure.

Always check heat pump system for pressure with a manifold gauge set to determine if refrigerant is present in the system. Performing recovery on an heat pump system which is open to atmosphere as a result of a leak, would allow the recovery station to pull only air into the tank.

NOTICE: Failure to check for residual oil from the previous recovery can result in adding extra oil to the vehicle currently being serviced. This will also result in insufficient oil in the system previously work on and could possible contribute to premature compressor failure.

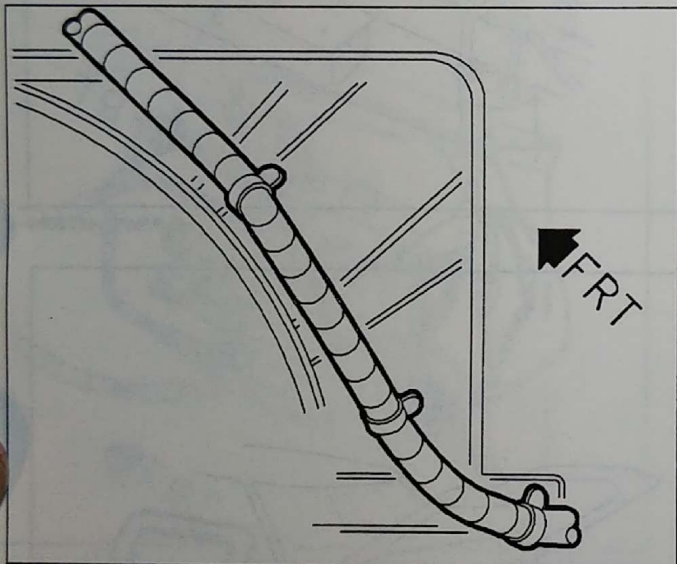


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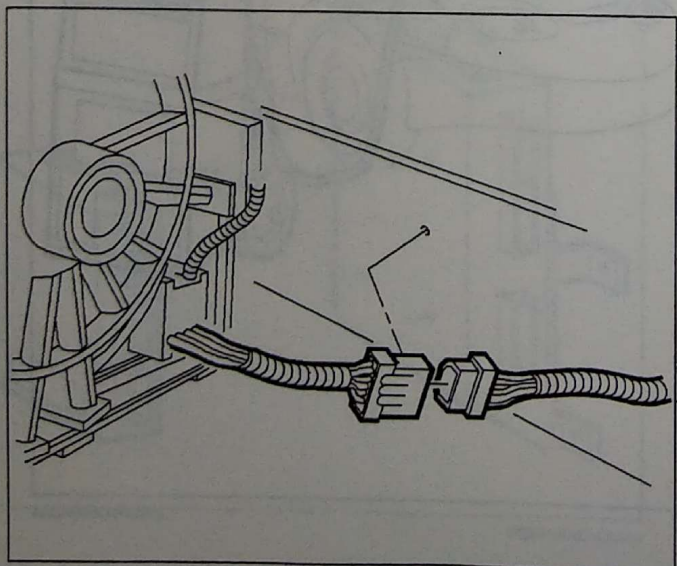
PSMPEN66554AA

5. Disconnect condenser tube from upper condenser fitting.



PSMPEN66656AA

6. Disconnect the charger receptacle cable rose bud retainers from fan shroud.



PSMPEN66396AA

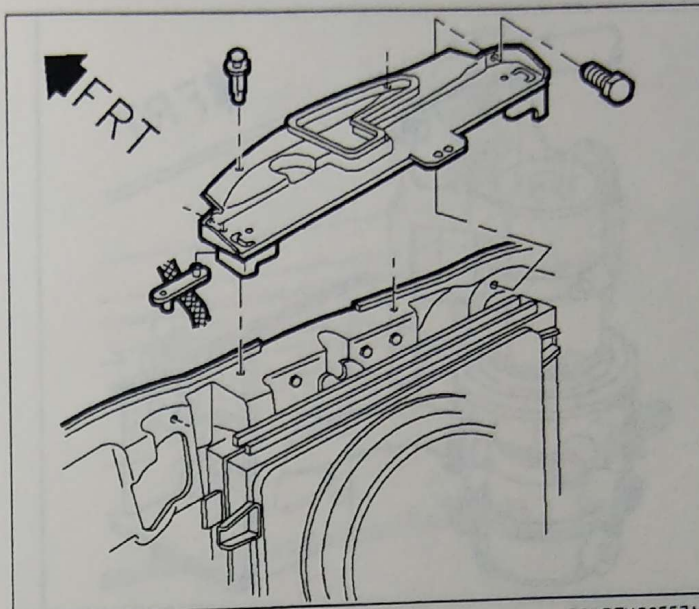
7. Disconnect fan motor buffer electrical connector at right hand mid-rail.



8. Remove fasteners from the CRFM upper mounting close out panel. Disconnect charger receptacle vent hose retainer from close out panel. Position panel over right side strut tower area.

9. Raise vehicle on hoist.

10. Remove underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" in this manual.)



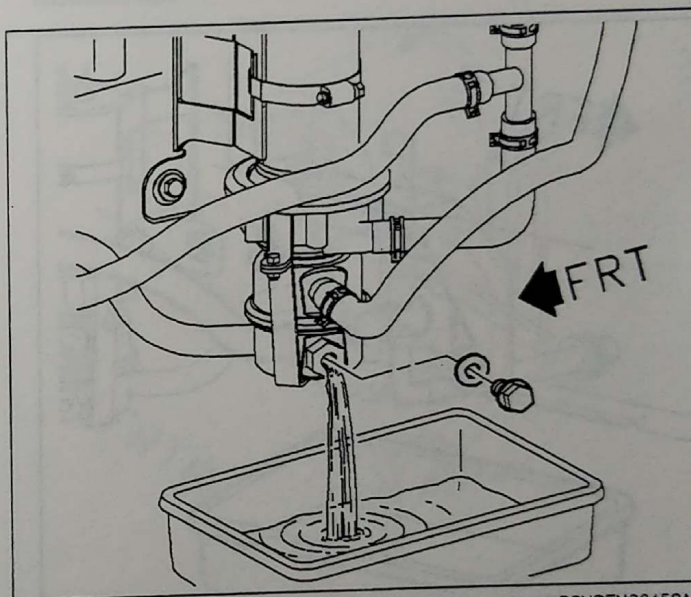
PSMPEN66553AA

11. Position drain pan under coolant pump manifold.

IMPORTANT: A two gallon container will be required to hold the coolant.

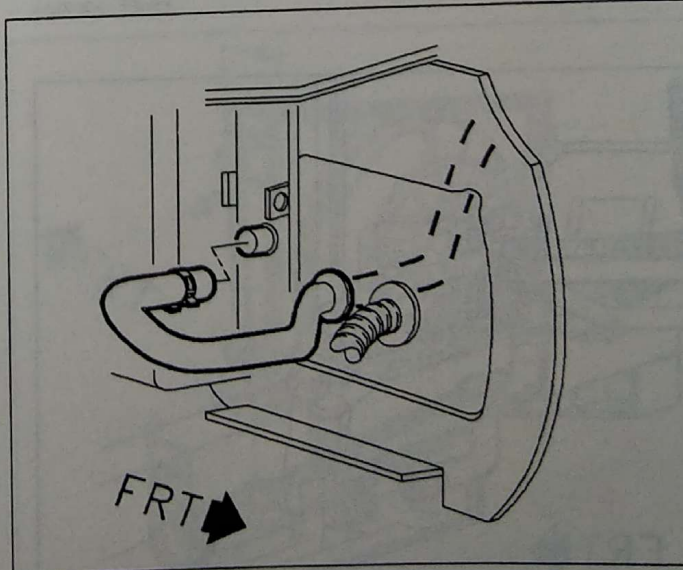
- a. Remove the drain plug and gasket from the coolant pump manifold allowing the coolant to flow from the main path, into container.
- b. After coolant has drained from the main path reinstall water pump manifold drain plug and gasket.

Torque: 11 N•m (97 in-lbs)



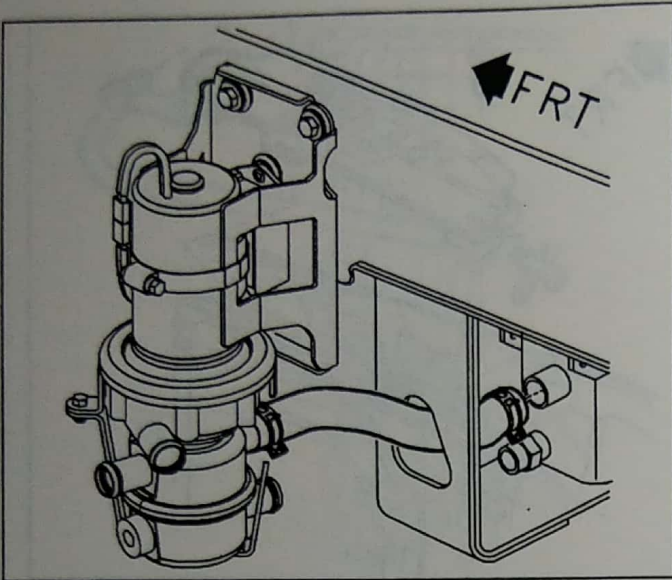
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12. Remove charger receptacle outlet hose from the radiator.



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13. Remove radiator outlet hose from radiator.

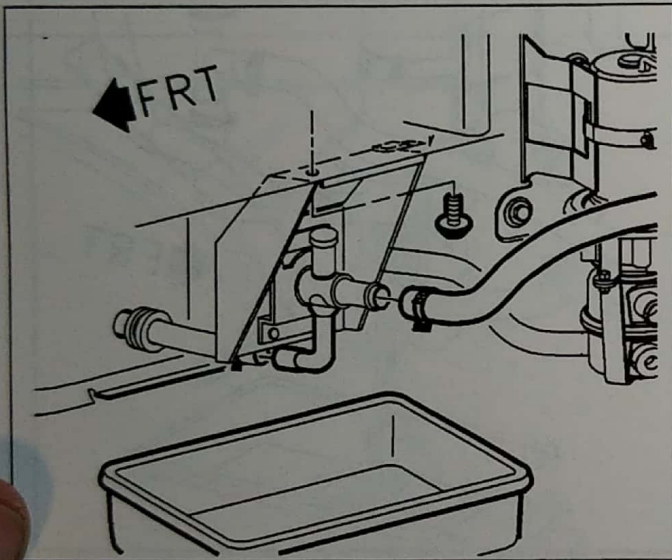


PSMPEN66465AB

14. Remove the charger receptacle inlet hose from charger receptacle coolant valve.

IMPORTANT: Coolant will flow from both the hose and the valve fitting.

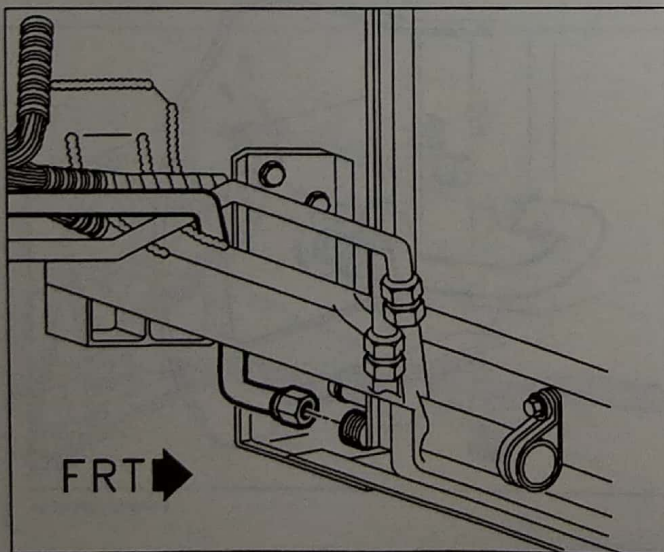
15. Remove fastener retaining charger receptacle coolant valve, and position valve out of way.



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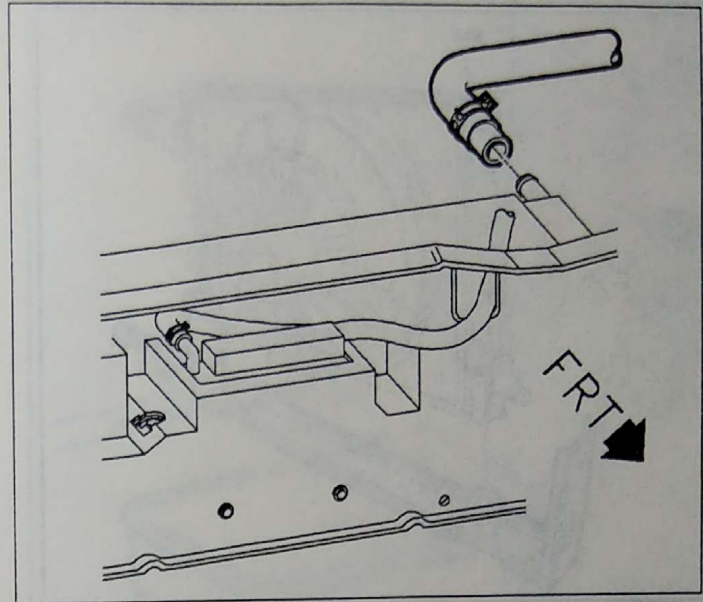
16. Disconnect the evaporator tube from condenser.

17. Lower vehicle on hoist.



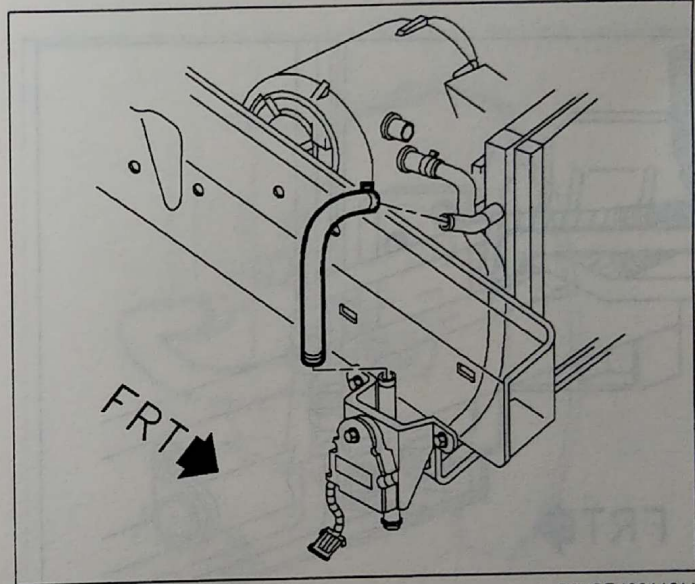
PSMPEN66398AB

18. Remove vent hose from radiator.



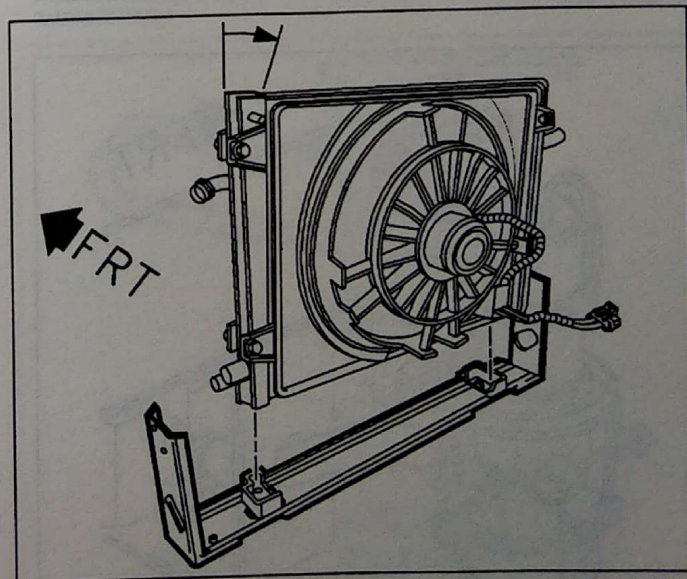
PSMPEN66562AA

19. Remove radiator inlet hose from radiator.



PSMPEN66446AA

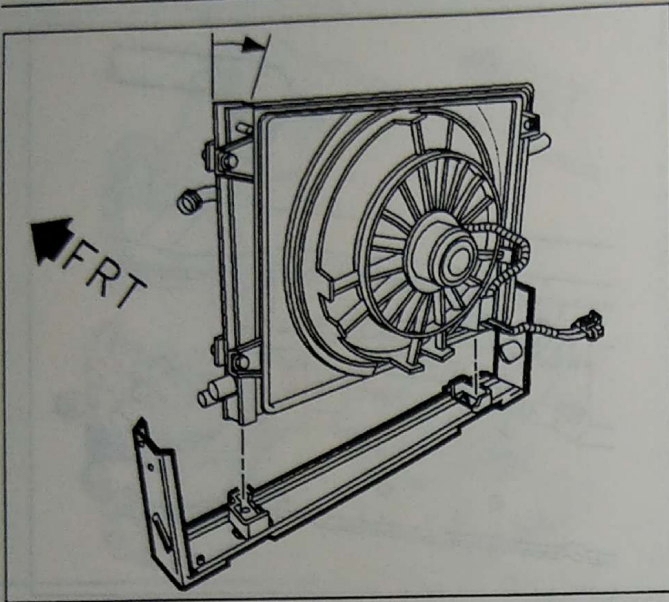
20. Tilt the top of the condensor, radiator fan module (CRFM) assembly rearward and lift out of CRFM lower mounting support.



PSMPEN66397AB

INSTALLATION

1. Tilt the top of the CRFM assembly rearward, align radiator and condenser to CRFM lower mounting support insulators.
2. Raise vehicle on hoist.

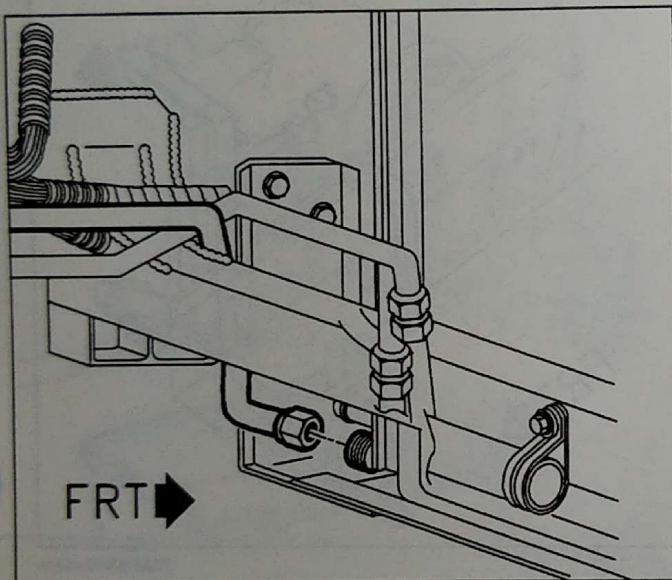


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NOTICE: Use only R-12 refrigerant oil (mineral) to lubricate O-rings. Use of R-134a (PAG) oil will cause premature corrosion of fitting joints.

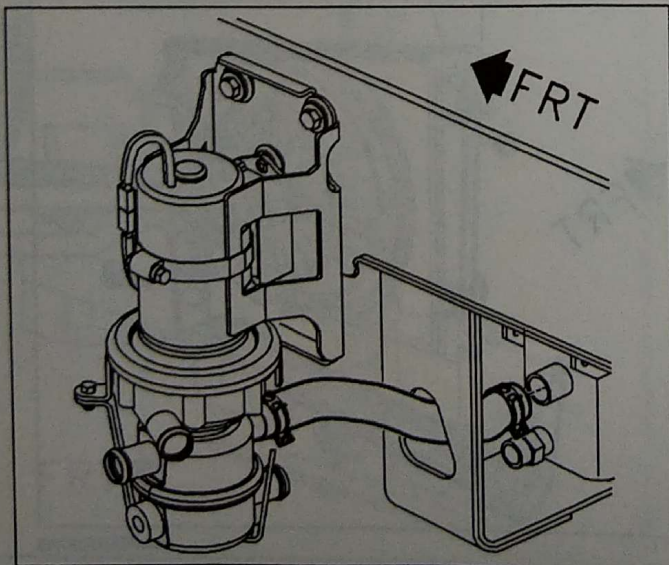
3. Lubricate with R-12 mineral oil and install new O-ring on lower A/C condensor tube.
4. Install lower A/C tube line connection to condensor.

Torque: 20 N•m (15 ft-lbs)



PSMPEN66398AB

5. Install radiator outlet hose to radiator. Position clamp tangs to 4 o'clock.

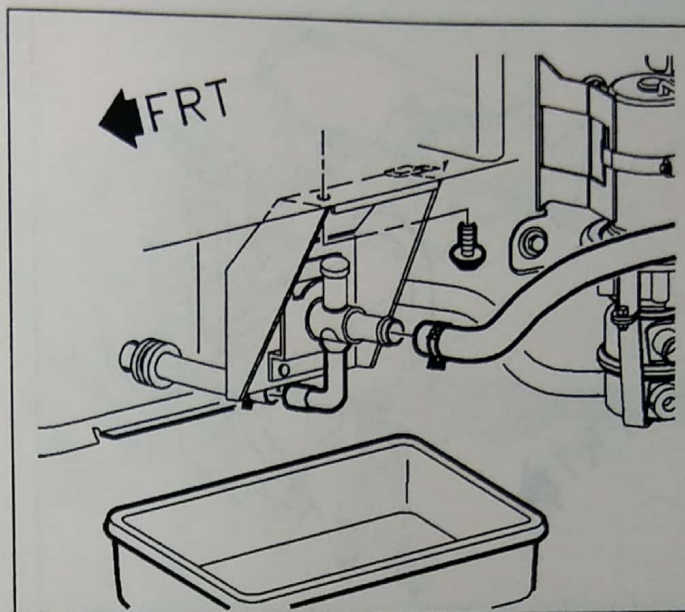


PSMPEN66465AB

6. Install the charger receptacle coolant valve.

Torque: 10 N•m (89 in-lbs)

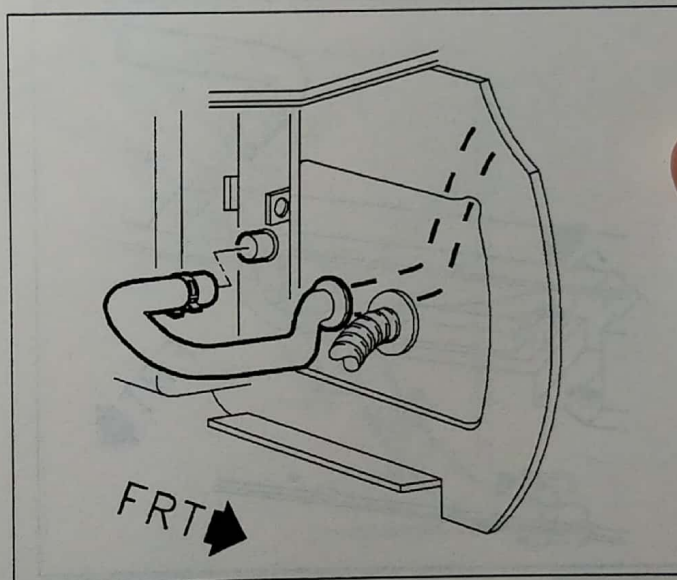
7. Install charger receptacle inlet hose to charger receptacle coolant valve. Position clamp tangs to 6 o'clock.



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8. Install charger receptacle outlet hose to the radiator. Position clamp tangs to 4 o'clock.

9. Lower vehicle on hoist.

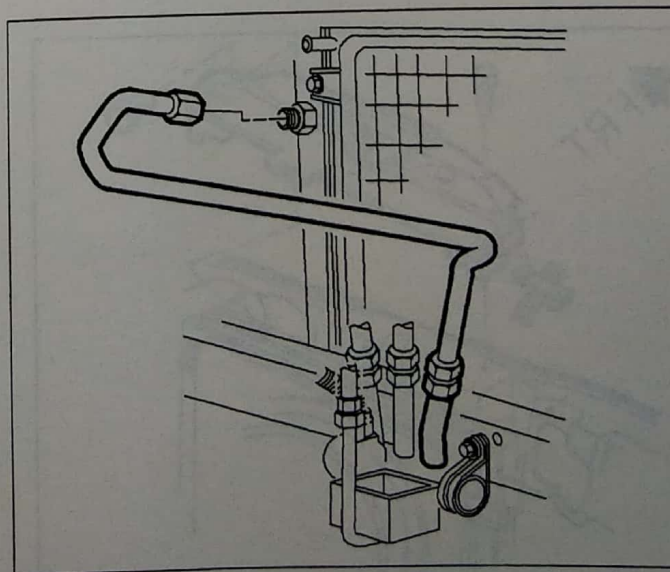


PSMPEN66652AA

NOTICE: Use only R-12 refrigerant oil (mineral) to lubricate O-rings. Use of R-134a (PAG) oil will cause premature corrosion of fitting joints.

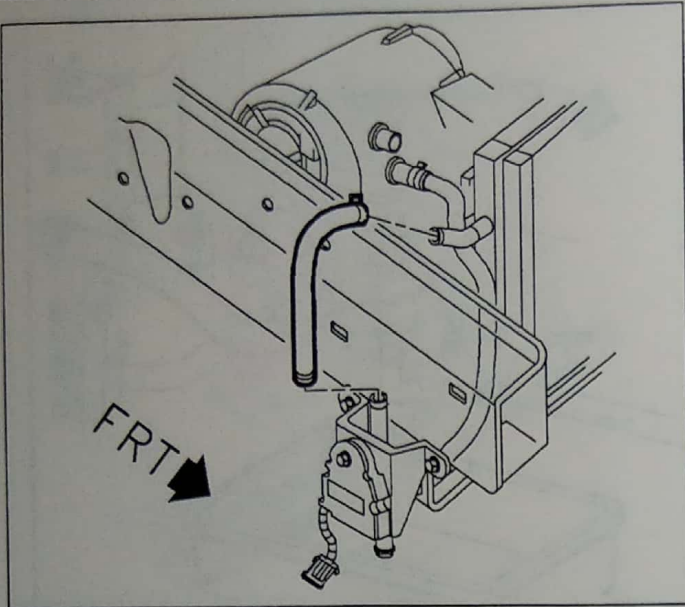
10. Lubricate with R-12 mineral oil and install new O-ring on upper A/C condensor tube.
11. Install upper A/C tube line connection to condensor.

Torque: 20 N•m (15 ft-lbs)



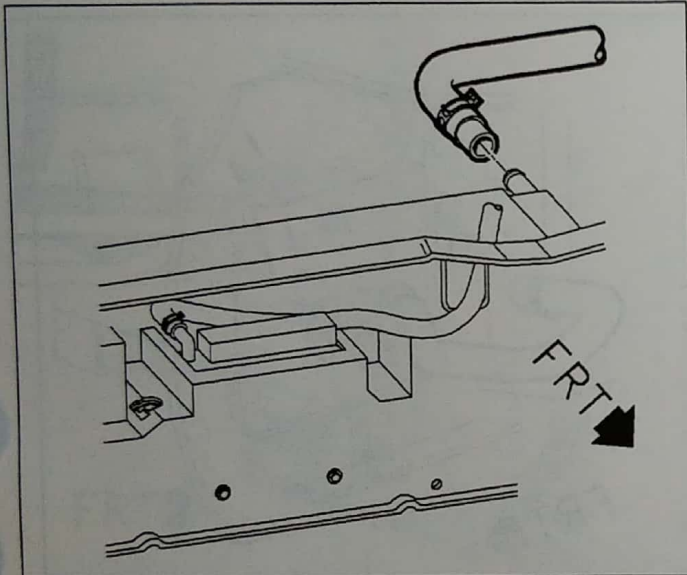
PSMPEN66554AA

12. Install radiator inlet hose to radiator. Position clamp tangs to 12 o'clock.



PSMPEN66446AA

13. Install radiator vent hose to radiator. Position clamp tangs to 12 o'clock.

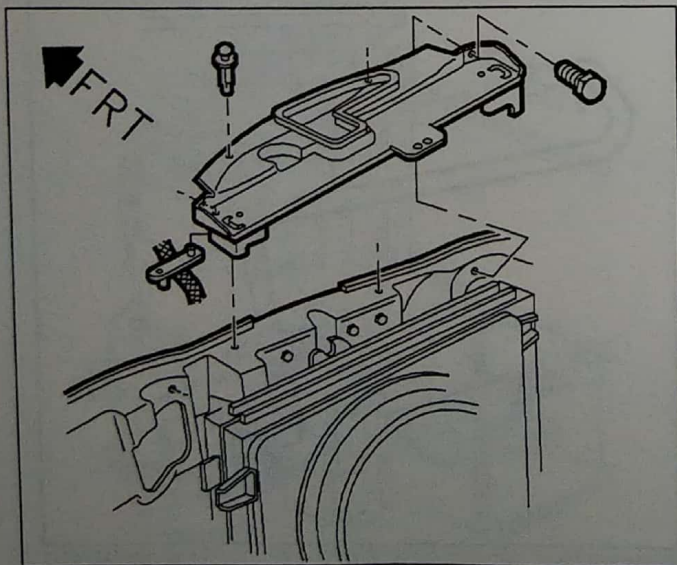


PSMPEN66562AA

14. Connect charger receptacle vent hose retainer to radiator upper mounting close out panel.

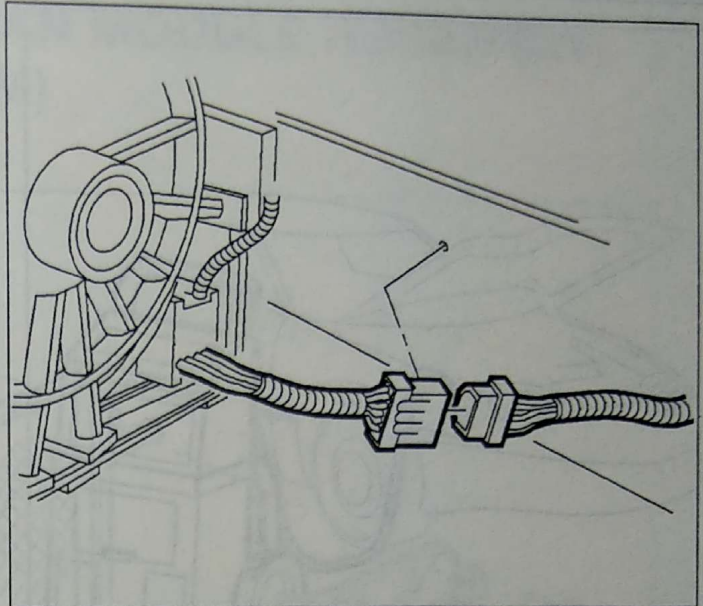
15. Install radiator upper mounting close out panel.

Torque: 10 N•m (89 in-lbs)



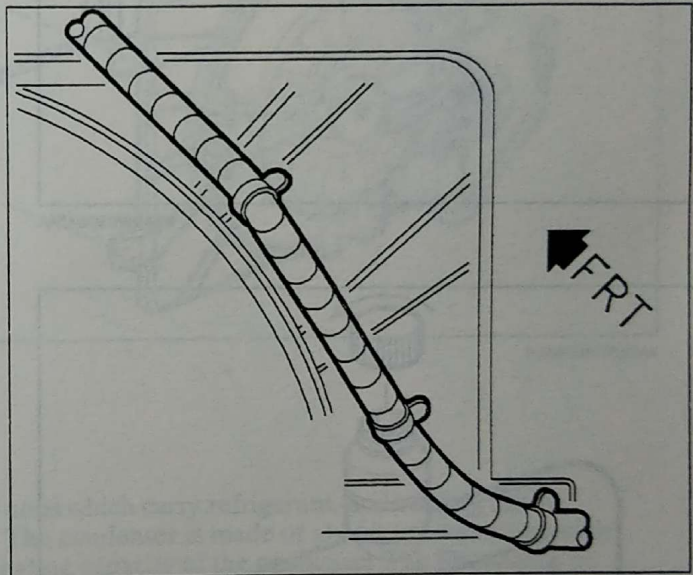
PSMPEN66553AA

16. Connect fan motor buffer electrical connector at right hand mid-rail.

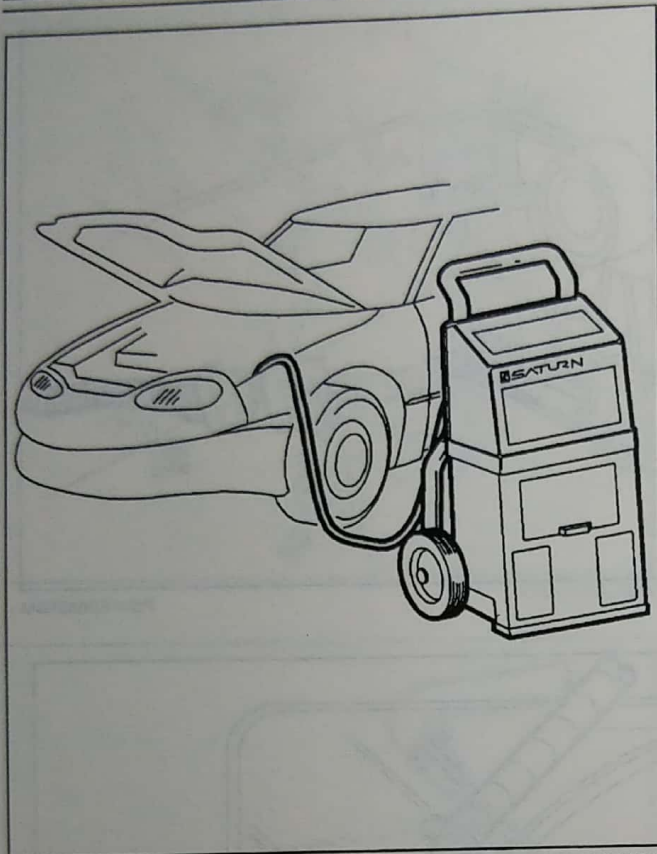


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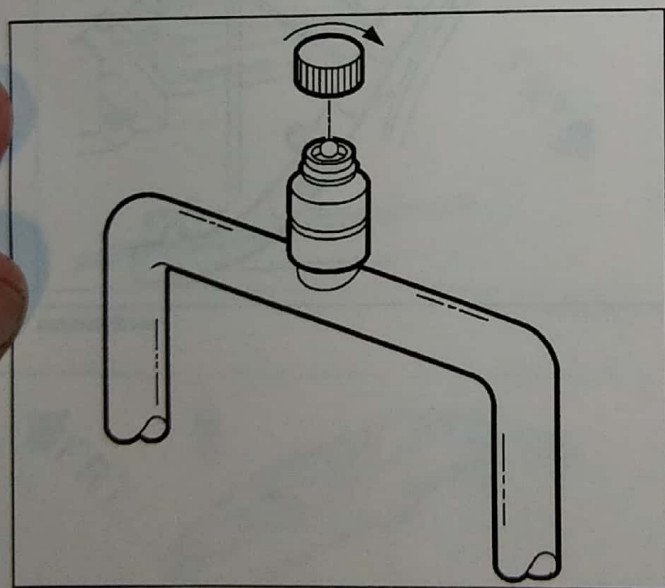
17. Connect charger receptacle cable rose bud retainers to fan shroud.
18. Enable high voltage. (Refer to "Enable High Voltage" procedure in this manual.)



PSMPEN66656AA

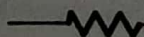


PSMHVC66645AA

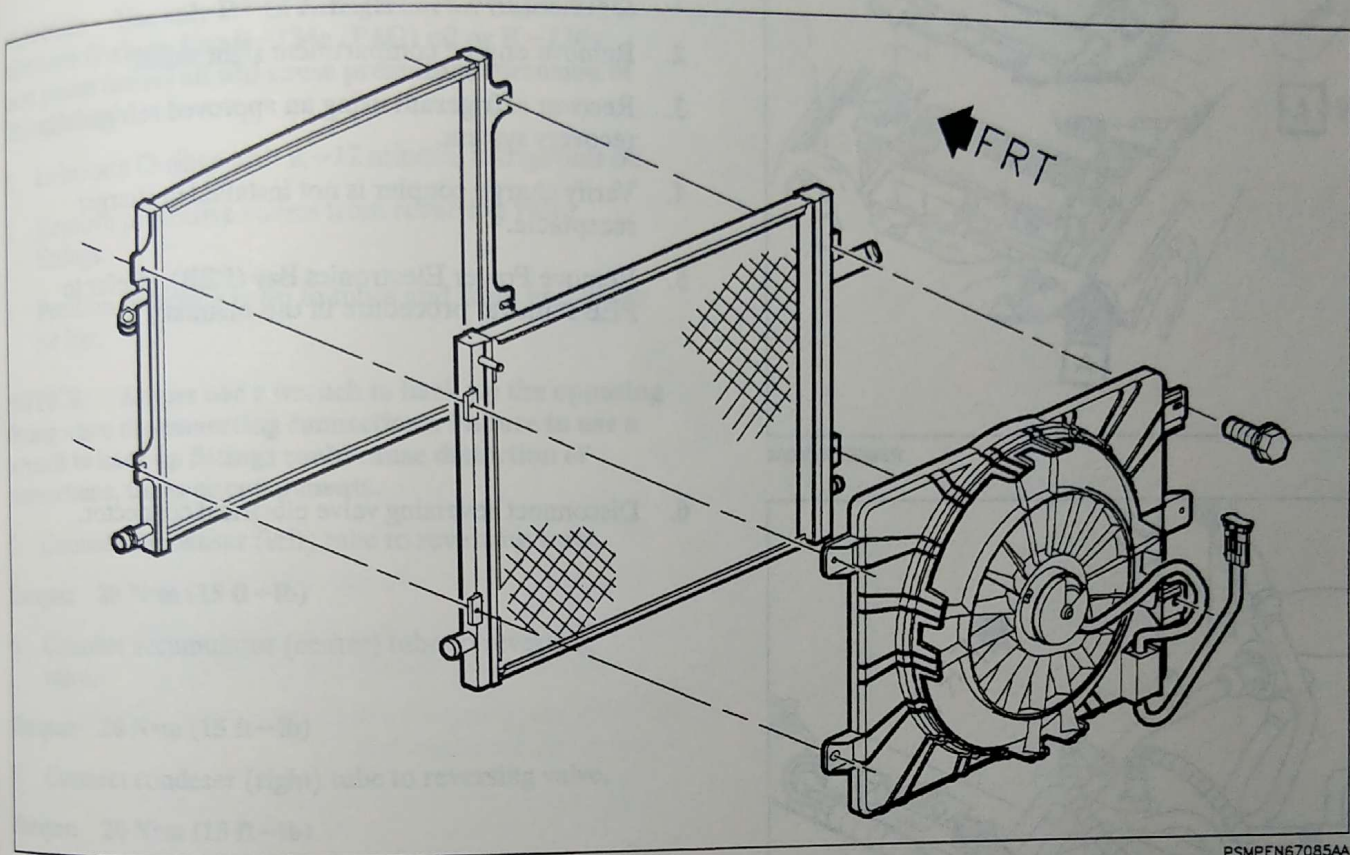


PSMHVC66646AB

19. Evacuate heat pump system. Install new Electric Vehicle approved service replacement heat pump schrader valves prior to evacuating system. Even though a schrader valve may look the same, it is extremely important that only recommended service replacement heat pump schrader valves be used or leakage of refrigerant will occur.
 20. The refrigerant system must be evacuated using an air conditioning refrigerant recovery and recycling system. Follow the manufacturers operating instruction for system being used.
 21. Allow system to evacuate for the predetermined time on the refrigerant recovery and recycling system. Note vacuum gauge readings.
 22. Watch low side gauge for vacuum loss (one to three minutes). If loss is less than 3.38 kPa (1 in. Hg) from level recorded in Step 21, proceed to charging the heat pump system.
 23. If vacuum loss is greater than 3.38 kPa (1 in. Hg) from level recorded in Step 21, charge with 0.23 kg (1/2 lb.) R-134a. Leak test, repair leaks and re-test.
 24. The refrigerant system must be charged using a R134a air conditioning refrigerant charging system. Follow the manufacturers operating instructions for system being used with the following exceptions.
 25. Do not connect low pressure valve on the charging station closed at all times.
 26. Perform the entire charge procedure through the high-pressure service fitting on the discharge pipe.
 27. Charge the heat pump system with 0.91 kg (2.0 lbs.) of R134a refrigerant.
- IMPORTANT:** Make sure there is an O-ring seal inside of caps before installation because the cap is the primary seal for heat pump system service fittings. Failure to tighten cap will result in refrigerant leakage.
28. Fill coolant system as outlined in "Fill Coolant System" procedure found in this section.
 29. Install underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" in this service manual.)



CONDENSER, RADIATOR, FAN MODULE ASSEMBLY (CRFM)



PSMPEN67085AA

GENERAL DESCRIPTION

The condenser assembly in front of the radiator is made up of coils which carry refrigerant, and cooling fins to provide rapid transfer of heat during heating and A/C modes. The condenser is made of aluminum tubes on which are mounted aluminum fins. The fins provide the cooling or heating capacity of the condenser. The fins should be kept clean and less than 20 percent of the fins should be bent or otherwise damaged.

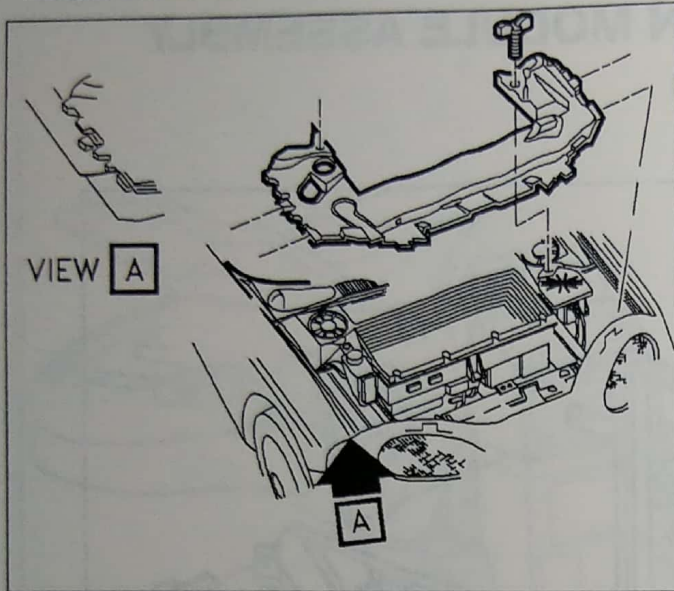
The radiator is a cross-flow type with the tanks located on the right and left of the core.

The coolant fan is 10 mm (5 in) long with seven unequally spaced blades to provide air flow through the radiator/condenser. The fan is driven by an electric motor which is attached to the radiator shroud. The electric fan motor is controlled by the HTCM based on coolant temperature and A/C request. The voltage to the electric fan motor is pulse width modulated to reduce current surge and increase motor life.

HEATER AND A/C REFRIGERANT REVERSING VALVE ASSEMBLY

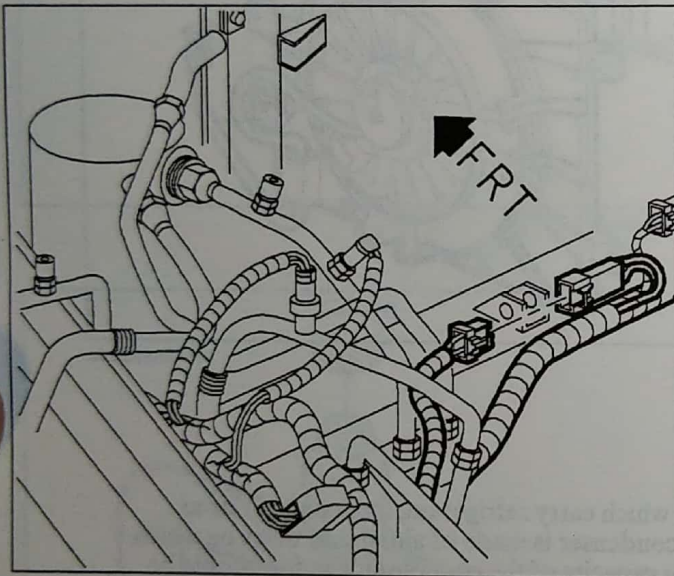
REMOVAL

1. Place key pad in "LOCK" mode.
2. Remove engine compartment sight shield.
3. Recover refrigerant using an approved refrigerant recovery system.
4. Verify charge coupler is not installed in charger receptacle.
5. Remove Power Electronics Bay (PEB). (Refer to PEB removal procedure in this manual.)



PSMGEP65869AC

6. Disconnect reversing valve electrical connector.

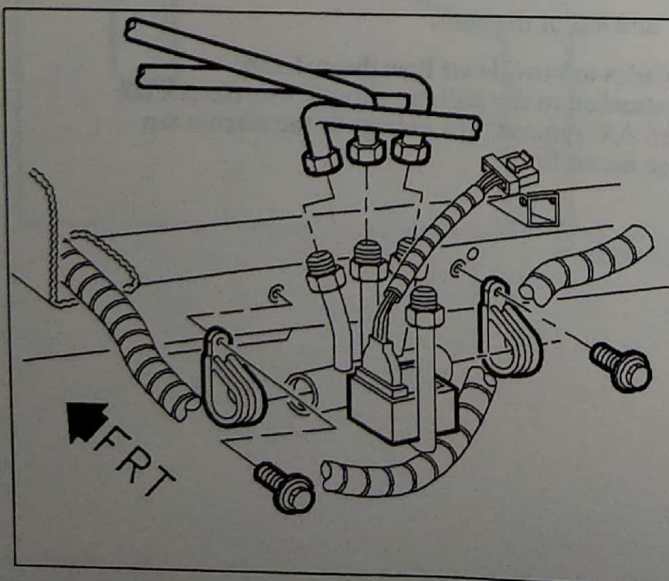


PSMHVC66495AA

7. Remove reversing valve retainers from front lower tie bar.

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

8. Disconnect condenser (right) tube from reversing valve.
9. Disconnect accumulator (center) tube from reversing valve.
10. Disconnect condenser (left) tube from reversing valve.
11. Disconnect reversing valve (rear) tube from reversing valve.
12. Remove reversing valve from vehicle.



PSMHVC66803AA

INSTALLATION

1. Remove O-rings from all four tube fittings that connect to reversing valve and install new Electric Vehicle approved service replacement O-rings.

NOTICE: Use only R-12 Refrigerant oil (mineral) to lubricate O-rings. Use R-134a (PAG) oil or R-134a heat pump (ester) oil will cause premature corrosion of fitting joints.

2. Lubricate O-rings with R-12 mineral refrigerant oil.
3. Remove protective covers from reversing valve fittings.
4. Position reversing valve to tubes and front end lower tie bar.

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

5. Connect condenser (left) tube to reversing valve.

Torque: 20 N•m (15 ft-lb)

6. Connect accumulator (center) tube to reversing valve.

Torque: 20 N•m (15 ft-lb)

7. Connect condenser (right) tube to reversing valve.

Torque: 20 N•m (15 ft-lb)

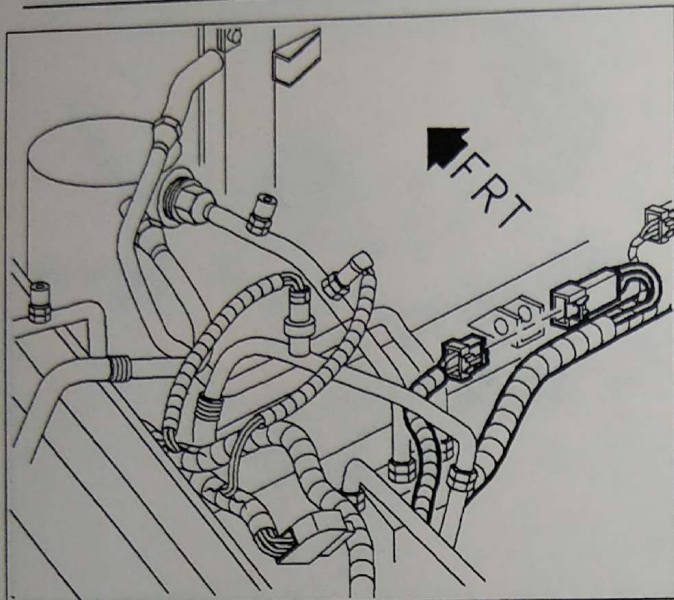
8. Connect reversing valve (rear) tube to reversing fittings.

Torque: 20 N•m (15 ft-lb)

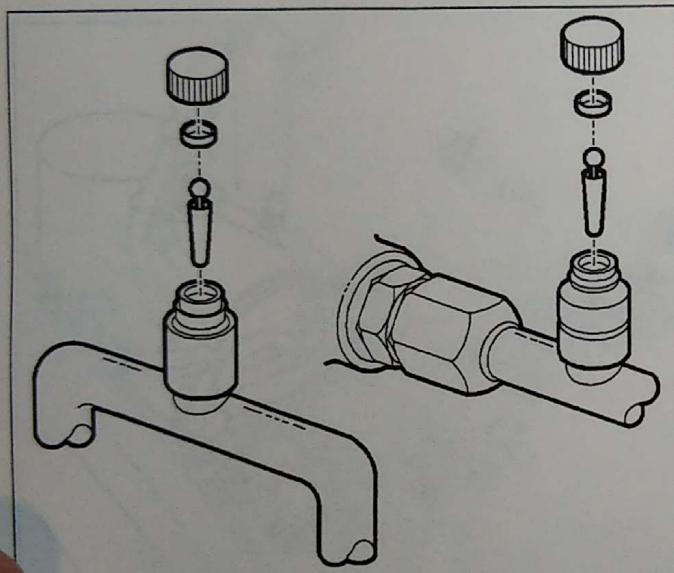
9. Install reversing valve retainers to front lower tie bar.

Torque: 10 N•m (89-lb)

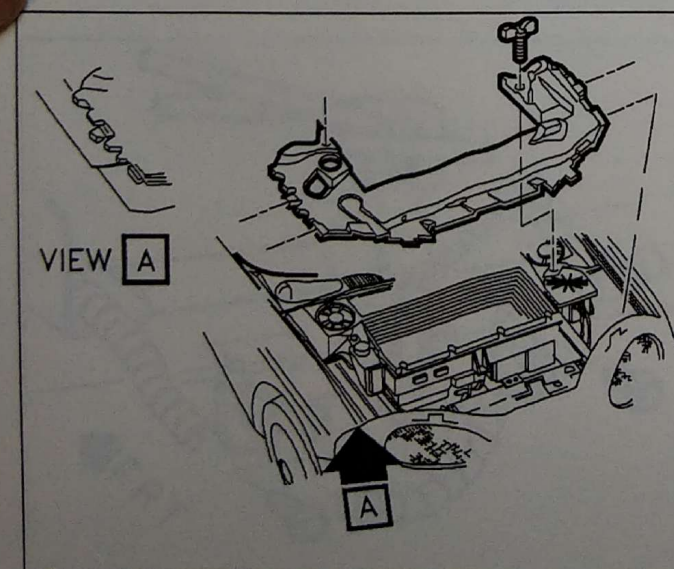




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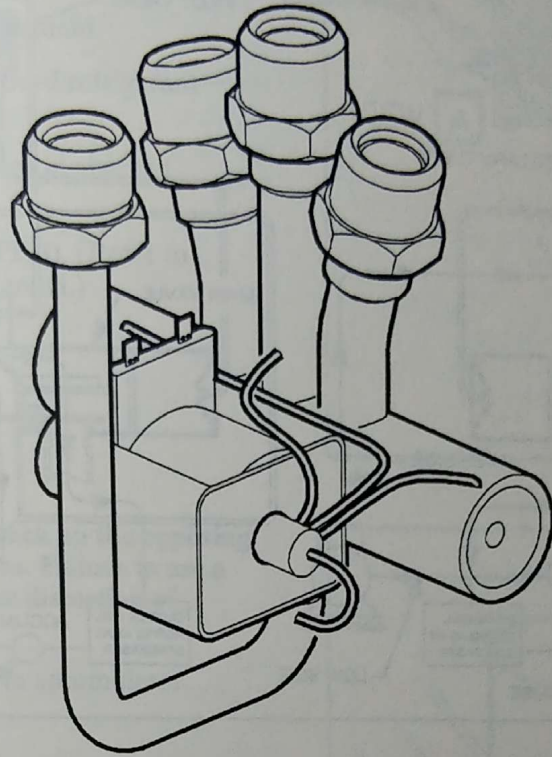
PSMGEP65869AC

10. Connect reversing valve electrical connector.

11. Install new Electric Vehicle approved service replacement heat pump schrader valves.
12. Evacuate, charge, and leak test heat pump system.
13. Install Power Electronics Bay (PEB). (Refer to PEB installation procedure in this manual.)
14. Verify heat pump system operation by performing system performance test.

15. Install engine compartment sight shield.

REVERSING VALVE ASSEMBLY



PSMHVC67399AB

GENERAL DESCRIPTION

The reversing valve assemblies purpose is to reverse the refrigerant route through the evaporator and condenser by means of a sliding port assembly, thereby exchanging the functions of the condenser and evaporator for heating-cooling modes. There are three main components to the reversing valve, a pilot valve, a solenoid activated by 12 volts controlled by the heat pump ventilation system/thermal control module, and the main valve.

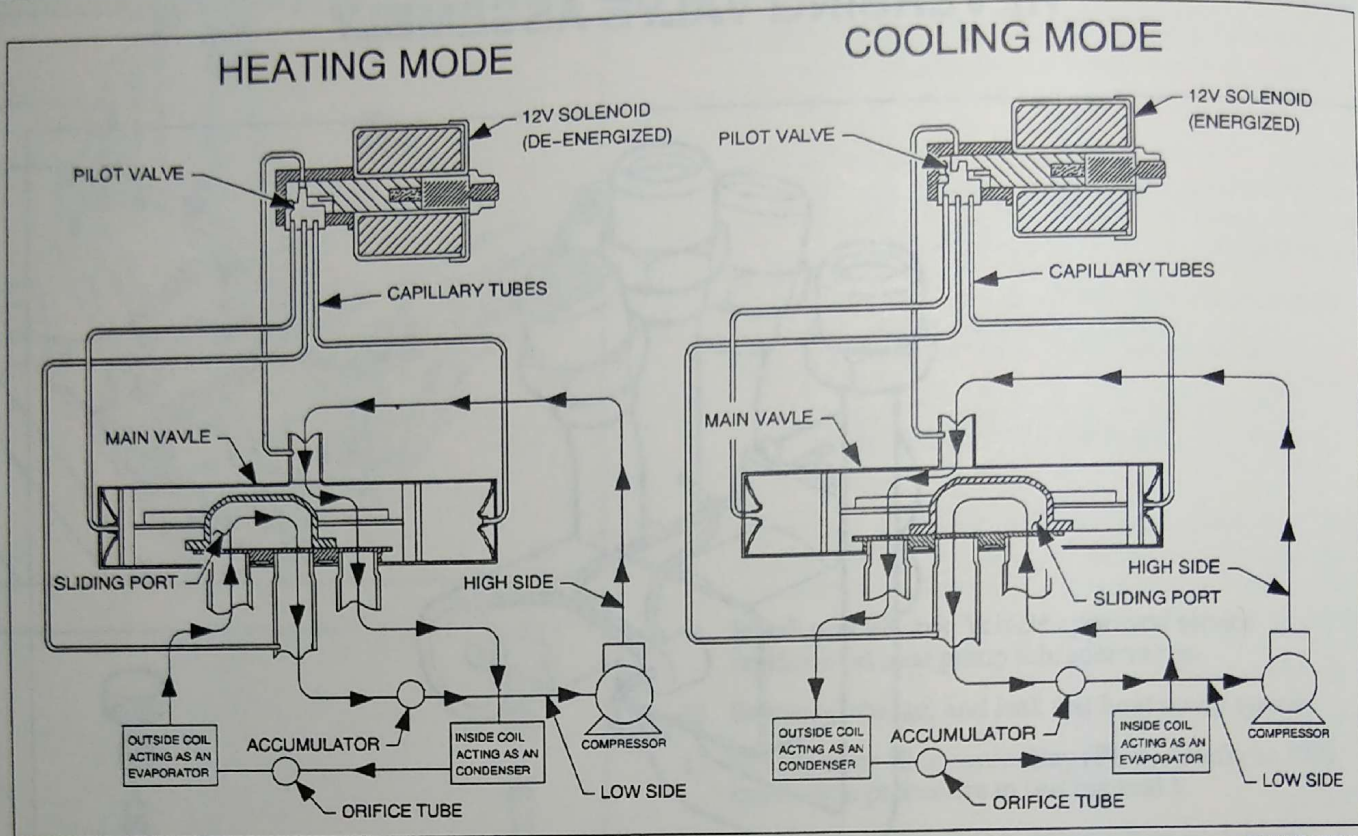
The pilot valve incorporates two spring loaded opposing needles, actuated by the 12 volt solenoid. The needles open and close two ports (left and right) in the pilot valve housing, which are connected by means of capillary tubing to opposite ends on the main valve body.

When the solenoid is energized, the needle for the right port is retracted, opening the right port, while the left port is closed by the left needle, which is spring loaded.

When the solenoid is de-energized, the right port is closed by the spring loaded right needle and the left port is opened. The position of the needles determines the gas escape path from the main valve during reversal.

The main valve has a sliding port within the housing, it is operated by the pressure differential between the high and low sides of the refrigeration system. There are three port tubes on one side of the valve housing. The center port is connected to the low pressure (suction) side of the system, while the other two tubes are connected to the condenser and evaporator assemblies.

The fourth tube port on the opposite side of the valve housing (not covered by the sliding port) is open to the high (discharge) side of the compressor directly through the valve housing, and provides the high pressure path to either the evaporator or the condenser, according to operating phase.



PSMHVC67509AB

When the solenoid is energized the right port in the pilot valve is opened, permitting the gas in the right hand chamber of the main valve to bleed off through the capillary tube, thereby causing a pressure differential between the right and left chambers. The higher pressure in the left hand chamber then causes the sliding port to move to the right. As the sliding port reaches the end of it's travel, a nylon needle in the end of the sliding port piston face seats and seals off the left hand capillary. This will reverse the operation of the heat pump system. When the valve is energized the system is in the cooling mode.

When the solenoid is de-energized the right port in the pilot valve will close and the left port will open, permitting the gas in the left hand camber of the main valve to bleed off through the capillary tube, causing a pressure differential between the left and right chambers. The higher pressure in the right hand chamber causes the sliding port to move to the left. As the sliding port reaches the end of it's travel, a nylon needle in the end of the sliding port piston face seats and seals off the left hand capillary. This will reverse the operation of the heat pump system. When the valve is de-energized the system is in the heating mode.

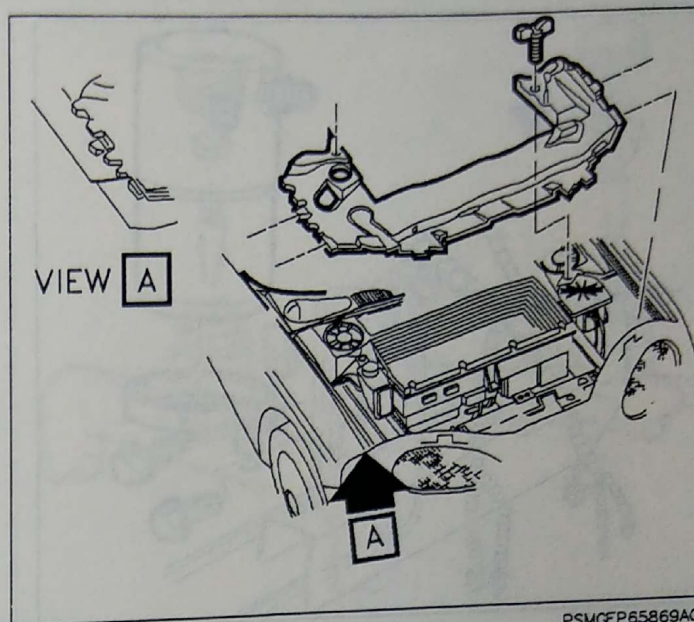
A/C ACCUMULATOR ASSEMBLY

REMOVAL

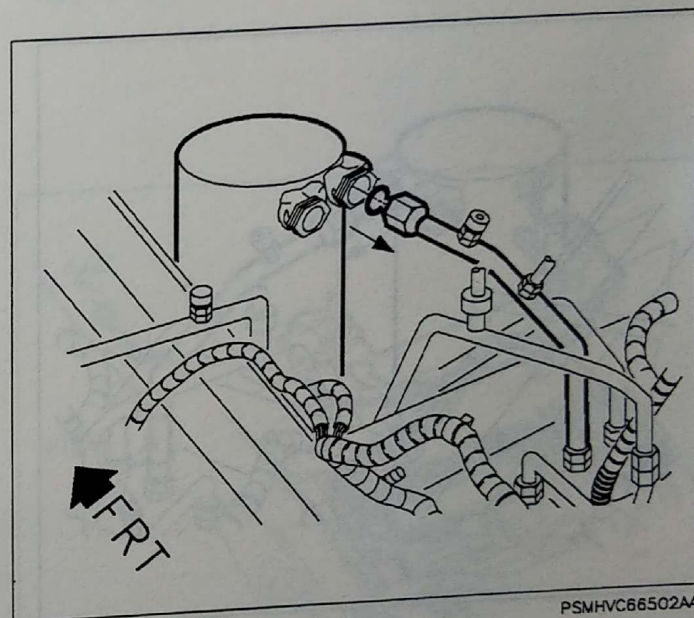
1. Place key pad in "LOCK" mode.
2. Remove engine compartment sight shield.
3. Recover refrigerant using an approved refrigerant recovery system.
4. Verify charge coupler is not installed in charger receptacle.
5. Remove Power Electronics Bay (PEB). (Refer to PEB removal procedure in this manual.)

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

6. Disconnect accumulator tube from accumulator.



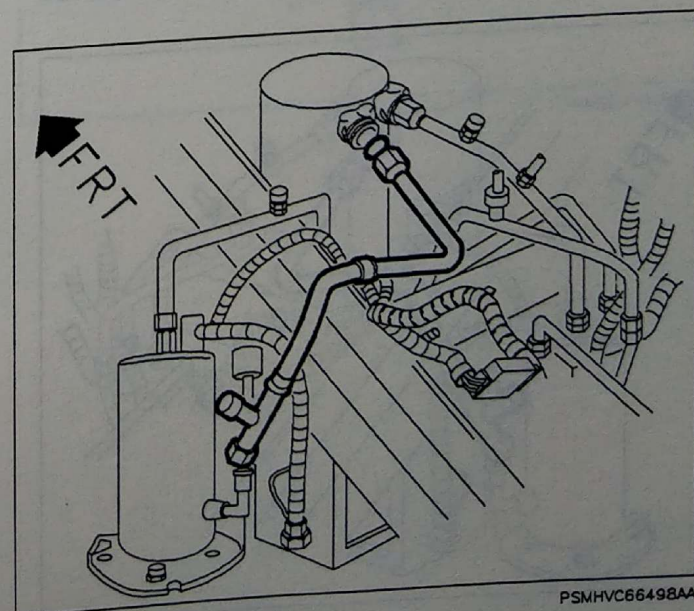
PSMGEP65869AC



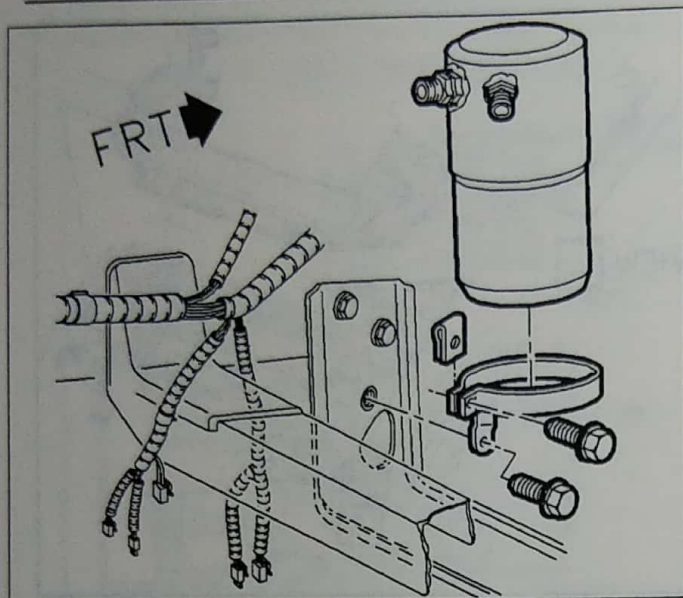
PSMHVC66502AA

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

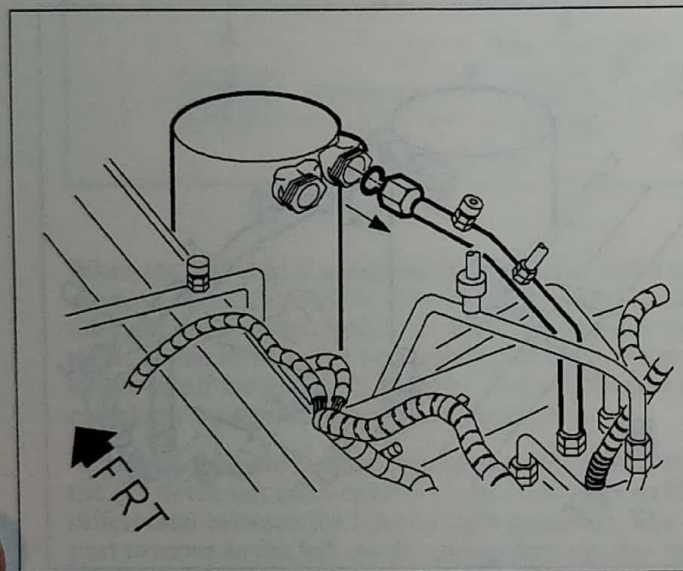
7. Disconnect suction tube from accumulator.



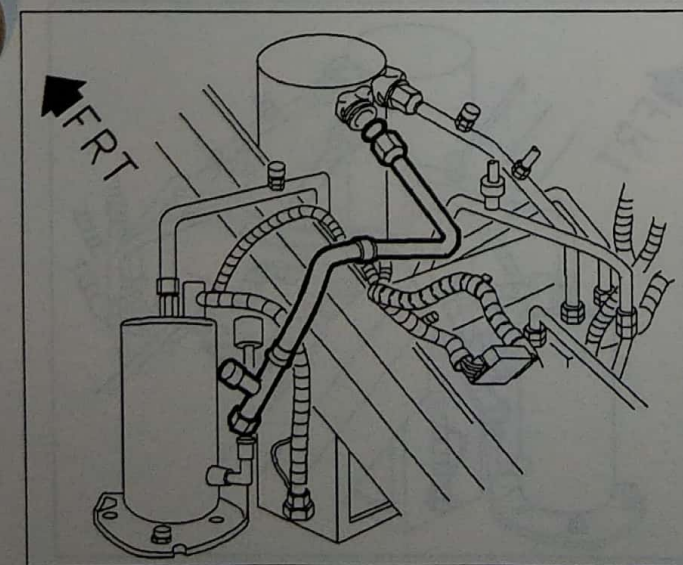
PSMHVC66498AA



PSMHVC66503AA



PSMHVC66502AA



PSMHVC66498AA

8. Remove accumulator band clamp bolt.
9. Remove accumulator from clamp and vehicle.

INSTALLATION

1. Install accumulator into clamp.

IMPORTANT: Make sure that the coolant recovery check valve and charger receptacle coolant valve wiring is between the front end lower tie bar and under mid-rail and clear of the accumulator and bracket.

2. Remove protective cover from accumulator tube fitting of accumulator.

3. Remove O-ring from accumulator tube fitting and install a new Electric Vehicle approved service replacement O-ring.

NOTICE: Use only R-12 Refrigerant oil (mineral) to lubricate O-rings. Use R-134a (PAG) oil or R-134a heat pump (ester) oil will cause premature corrosion of fitting joints.

4. Lubricate O-ring with R-12 mineral refrigerant oil.

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

5. Connect accumulator tube to accumulator.

Torque: 20 N•m (15 ft-lbs)

6. Install accumulator band clamp bolt and tighten.

Torque: 10 N•m (89 in-lbs)

7. Remove protective cover from suction tube fitting of accumulator.

8. Remove O-ring from suction tube fitting and install a new Electric Vehicle approved service replacement O-ring.

NOTICE: Use only R-12 Refrigerant oil (mineral) to lubricate O-rings. Use R-134a (PAG) oil or R-134a heat pump (ester) oil will cause premature corrosion of fitting joints.

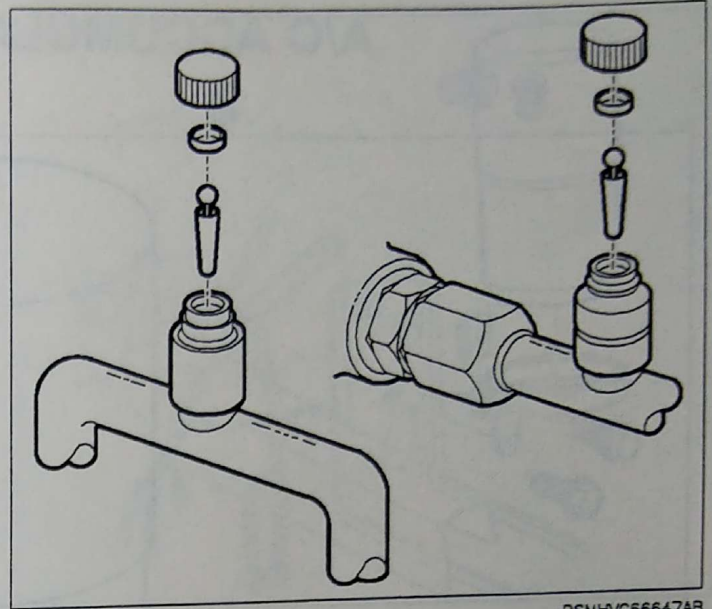
9. Lubricate O-ring with R-12 mineral refrigerant oil.

NOTICE: Always use a wrench to back up the opposing fitting when disconnecting connections. Failure to use a wrench to back up fittings could cause distortion of connections, tubes or components.

10. Connect suction tube to accumulator.

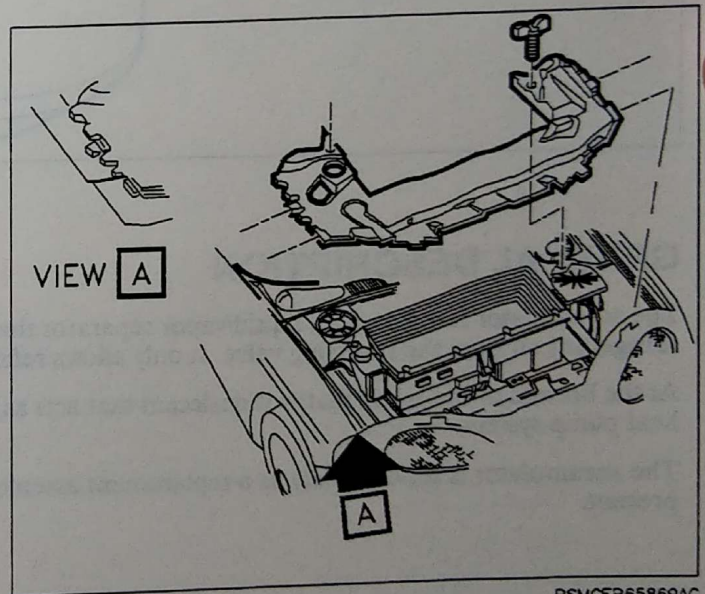
Torque: 20 N•m (15 ft-lbs)

11. Install new Electric Vehicle approved service replacement heat pump schrader valves.
12. Evacuate, charge, and leak test heat pump system.
13. Install Power Electronics Bay (PEB). (Refer to PEB installation procedure in this manual.)
14. Verify heat pump system operation by performing system performance test.



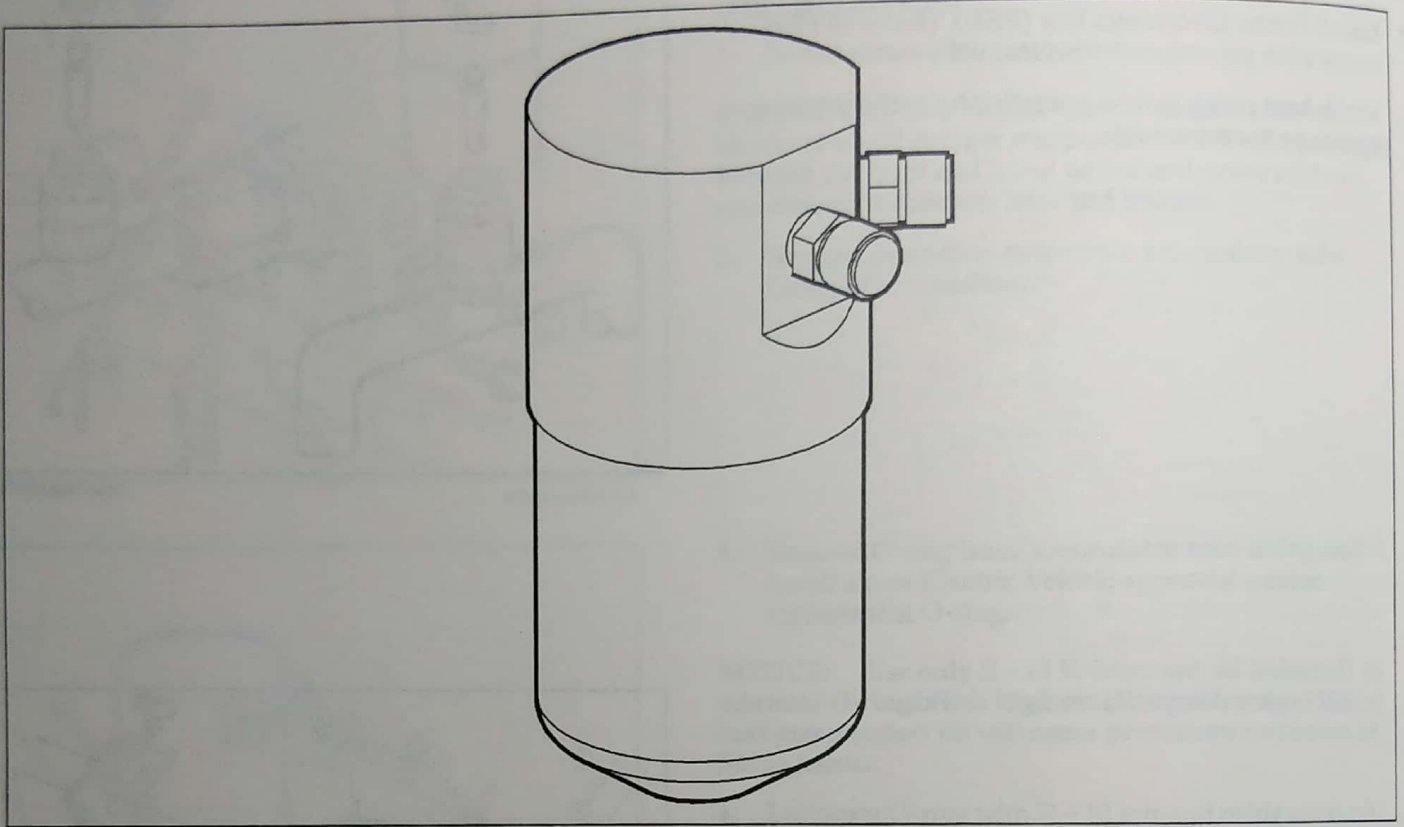
PSMHVC66647AB

15. Install engine compartment sight shield.



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A/C ACCUMULATOR ASSEMBLY



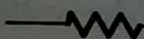
PSMHVC67398AA

GENERAL DESCRIPTION

The accumulator functions as a liquid/vapor separator that receives refrigerant vapor, some liquid refrigerant and refrigerant oil from the reversing valve. It only allows refrigerant vapor and oil to continue on to the compressor.

At the bottom of the accumulator is desiccant that acts as a drying agent for moisture that may have entered the heat pump system.

The accumulator is serviced only as a replacement assembly and should be replaced when ever oil contamination is present.



ACCUMULATOR BRACKET

REMOVAL

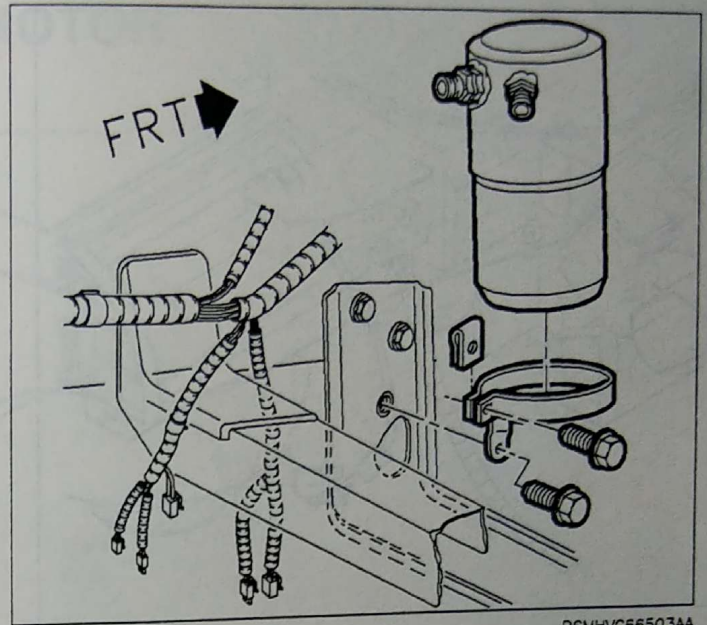
1. Remove accumulator. (Refer to "Accumulator Assembly removal" in this manual.)
2. Remove accumulator bracket bolt.
3. Remove accumulator bracket from vehicle.

INSTALLATION

1. Position accumulator bracket to condenser, radiator, fan module support.
2. Install accumulator bracket bolt and tighten.

Torque: 10 N•m (89 in-lbs)

3. Install accumulator. (Refer to "Accumulator Assembly installation" in this manual.)

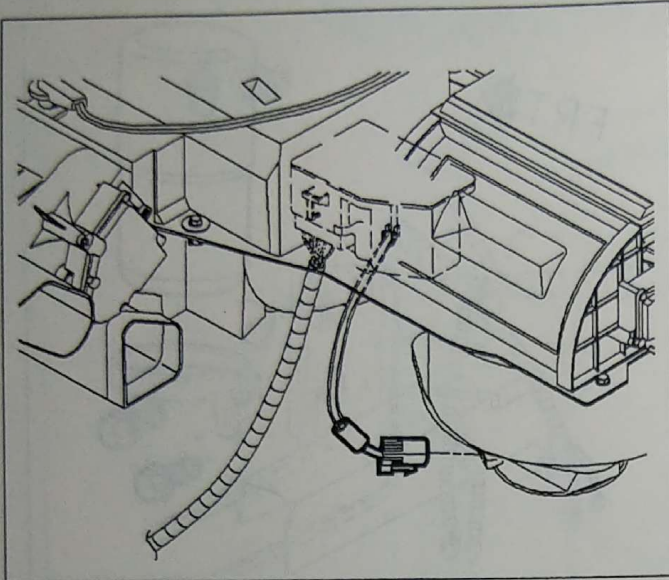


PSMHVC66503AA

BLOWER MOTOR ASSEMBLY

REMOVAL

1. Place keypad on "LOCK" mode.
2. Disconnect blower motor connector.



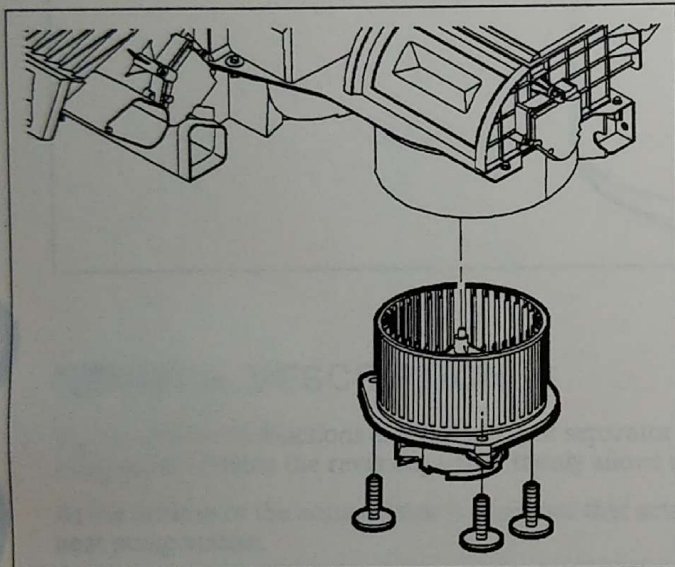
PSMHVC67561AA

3. Remove blower motor mounting screws.
4. Remove blower motor from heating and A/C module.

INSTALLATION

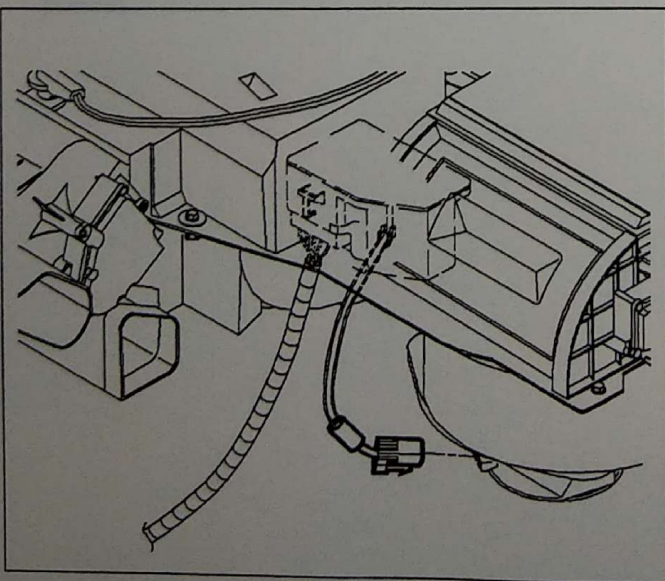
1. Install blower motor into heating and A/C module.
2. Install blower motor mounting screws.

Torque: 1.5 N•m (13 in-lbs)



PSMHVC67392AA

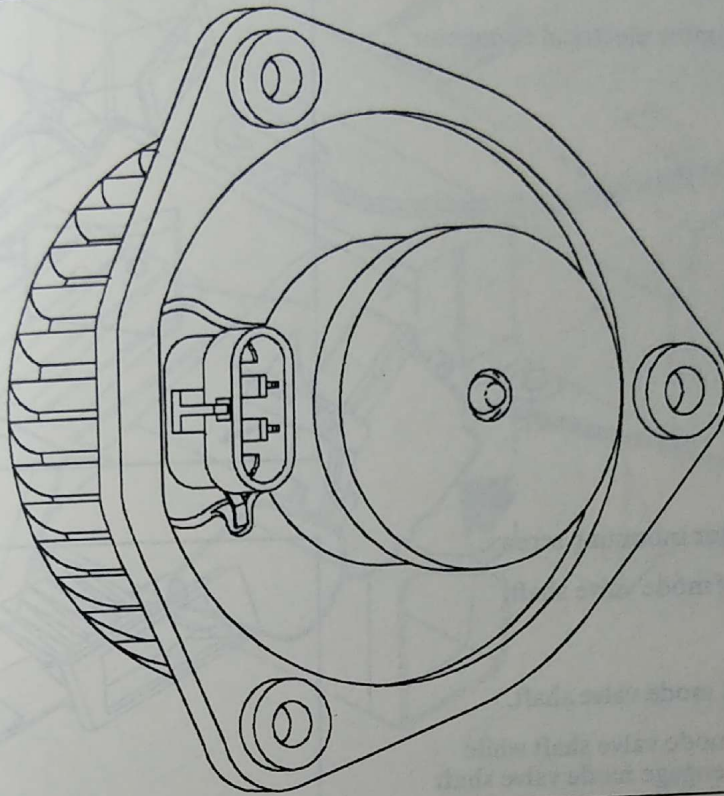
3. Connect blower motor connector.



PSMHVC67561AA



BLOWER MOTOR



SMHVC50681AA

GENERAL DESCRIPTION

The blower motor is a permanent magnet motor with a squirrel cage fan. Its purpose is to provide air flow to the passenger compartment. The blower speeds are controlled by buttons on the Run/Lock Shifter assembly (RSA). There are five speeds for cooling mode and five slightly slower speed for heating mode.

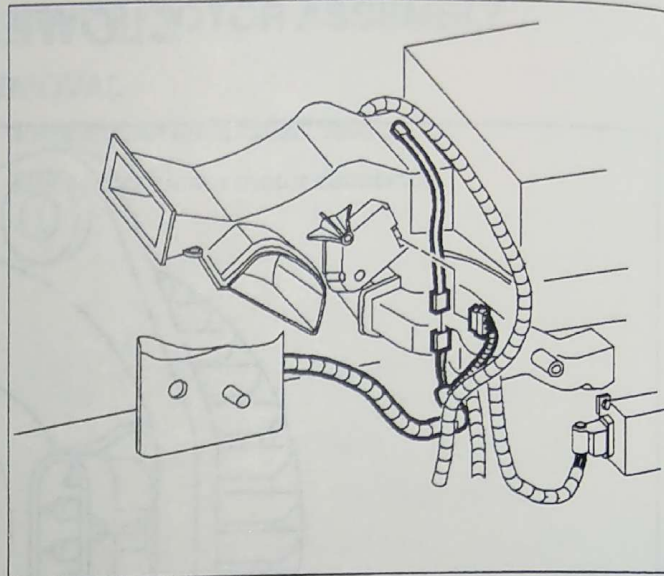
The 12 volt blower motor is pulse width modulated to control the blower speeds to reduce power consumption.

The blower motor and fan is a balanced assembly. Weights could be visible on the fan cage.

MODE VALVE ACTUATOR ASSEMBLY

REMOVAL

1. Place keypad on "LOCK" mode.
2. Disconnect mode valve actuator electrical connector.



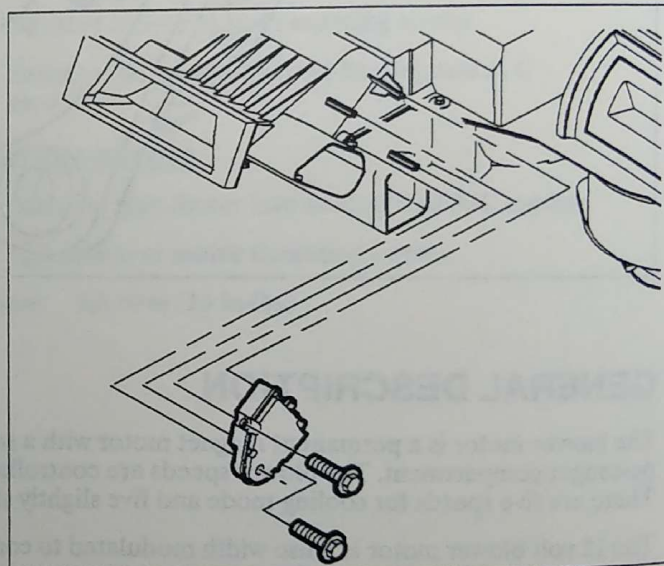
PSMHVC67533AA

3. Remove mode valve actuator mounting screws.
4. Pull actuator straight off of mode valve shaft.

INSTALLATION

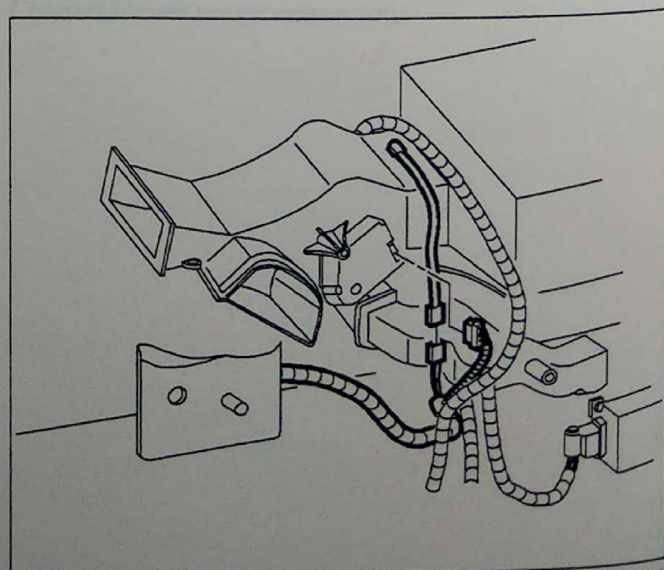
1. Align flats on actuator and mode valve shaft.
2. Push actuator straight on mode valve shaft while rotating back and forth to engage mode valve shaft into mode valve actuator.
3. Install mode valve actuator mounting screws.

Torque: 1.5 N•m (13 in-lbs)

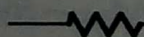


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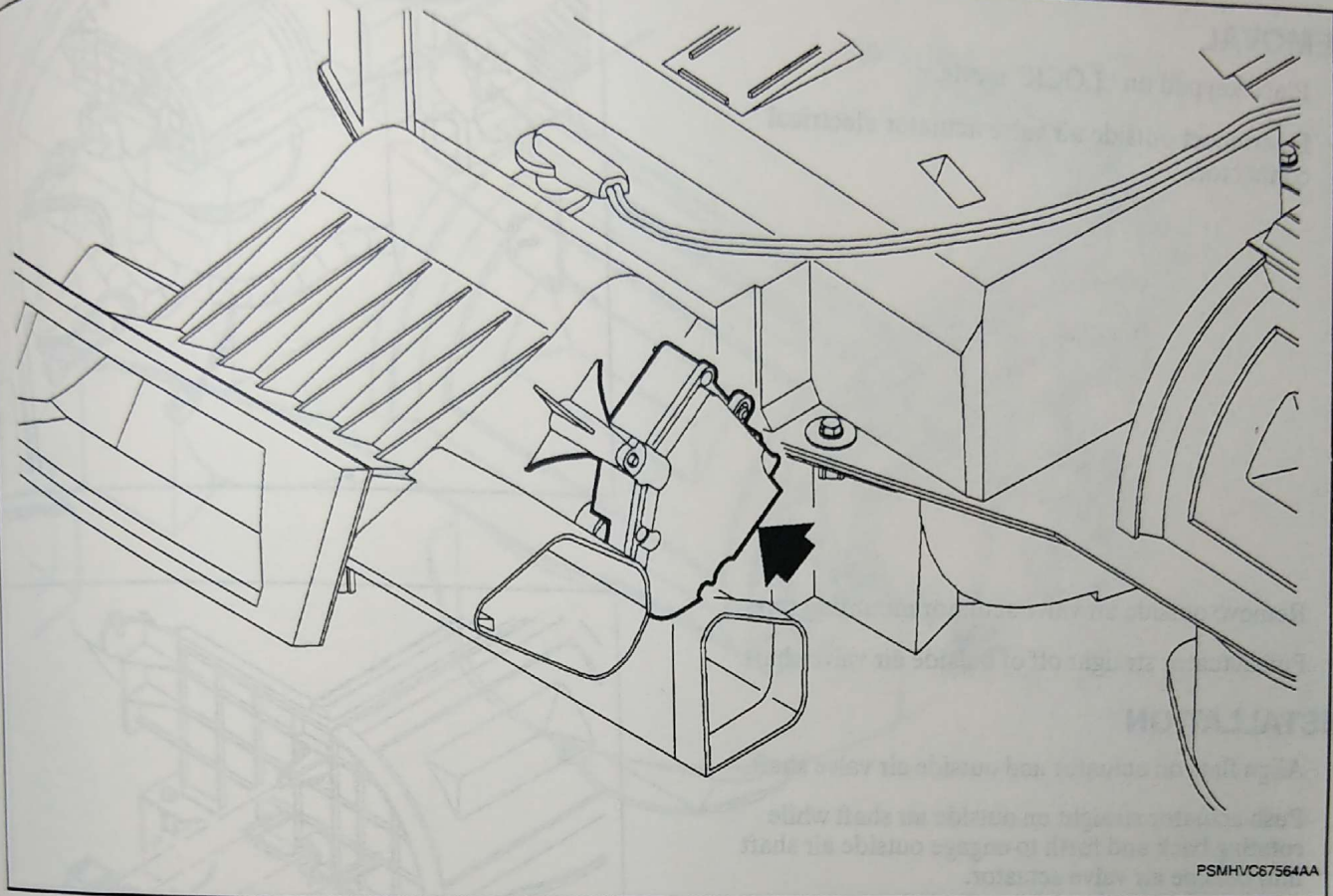
4. Connect mode valve actuator electrical connector.
5. Remove haz/run/acc/misc fuse from upper fuseblock to reset the feedback signal to the HTCM on power up. Wait one minute from power up for HTCM to reset before turning on heat pump system.



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MODE VALVE ACTUATOR ASSEMBLY



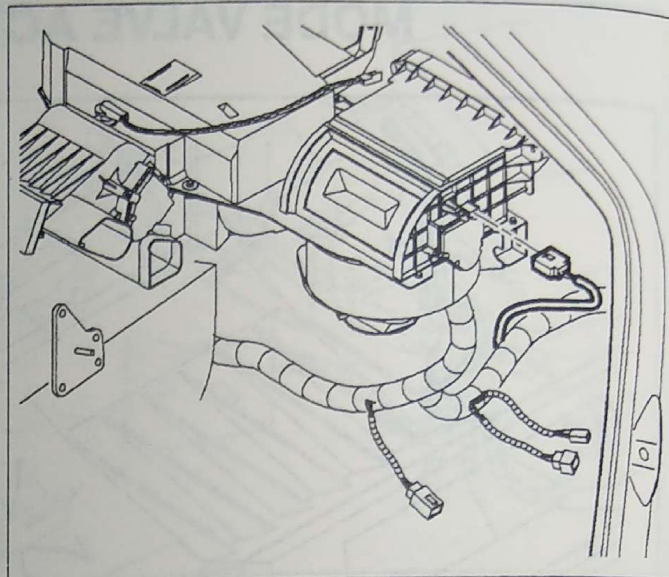
GENERAL DESCRIPTION

The mode valve actuator is a 12 volt electric motor with a 5 volt feedback circuit controlled by the HTCM. The mode valve actuator rotates a door within the heating and A/C module which diverts the air flow from the floor to the upper outlets in the instrument panel and door panels.

OUTSIDE AIR VALVE ACTUATOR ASSEMBLY

REMOVAL

1. Place keypad on "LOCK" mode.
2. Disconnect outside air valve actuator electrical connector.



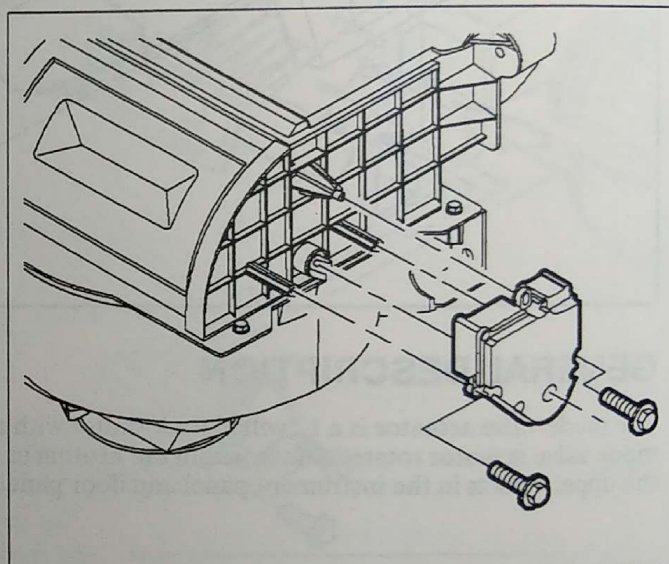
PSMHVC67532AA

3. Remove outside air valve actuator mounting screws.
4. Pull actuator straight off of outside air valve shaft.

INSTALLATION

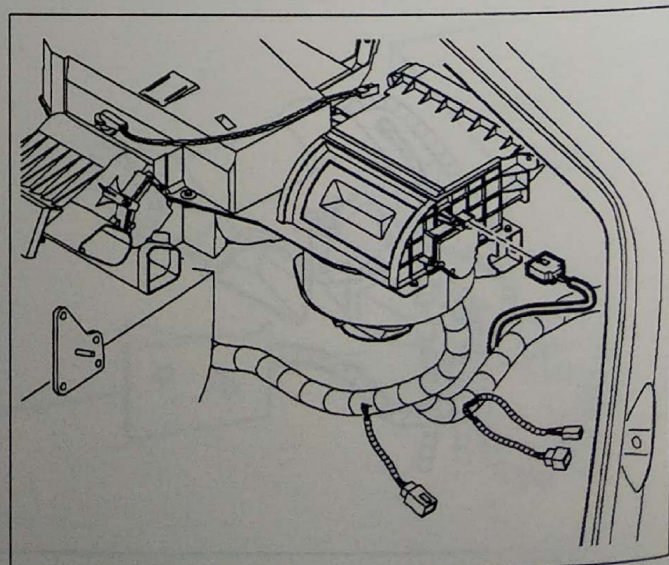
1. Align flats on actuator and outside air valve shaft.
2. Push actuator straight on outside air shaft while rotating back and forth to engage outside air shaft into outside air valve actuator.
3. Install outside air valve actuator mounting screws.

Torque: 1.5 N•m (13 in-lbs)

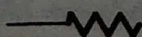


PSMHVC67394AB

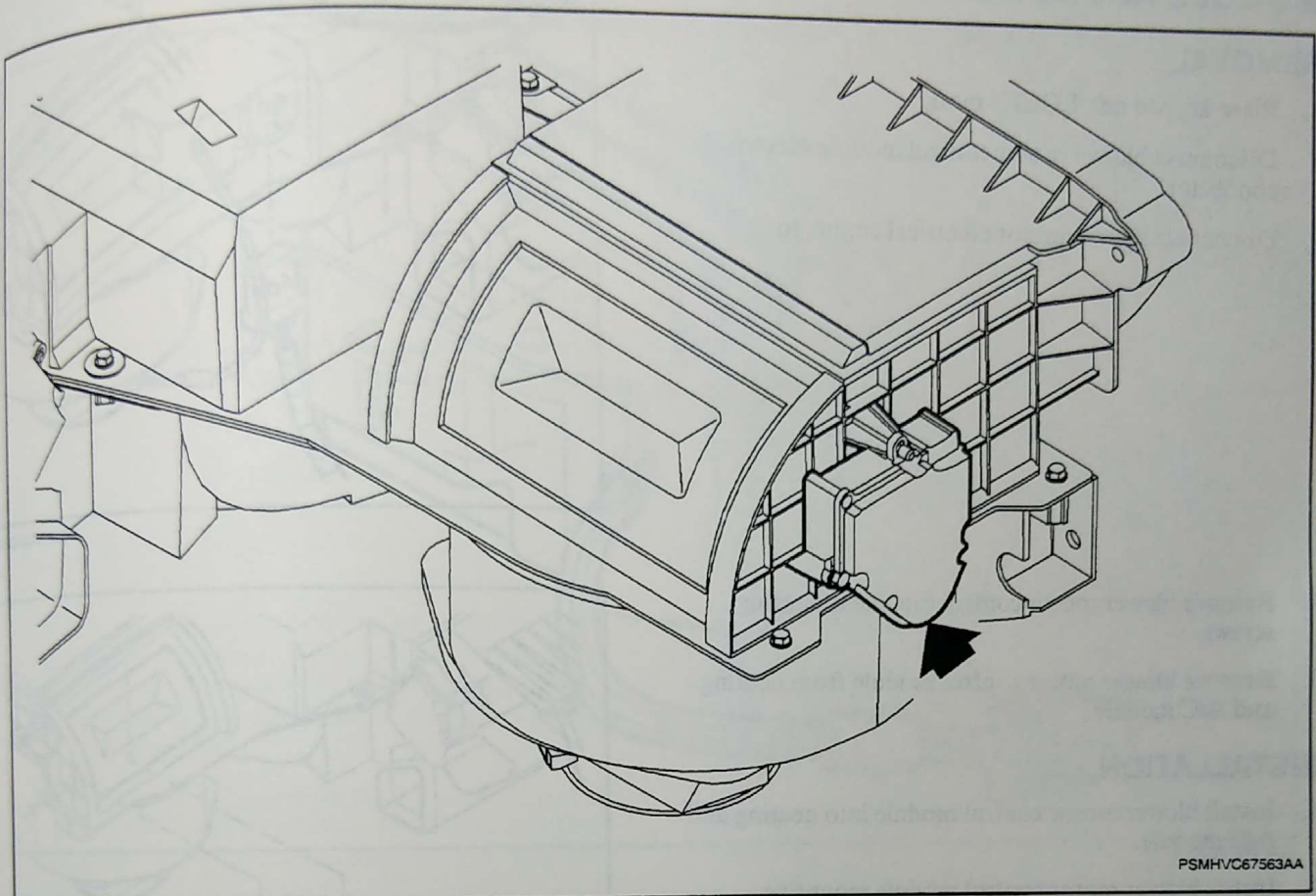
4. Connect outside air valve actuator electrical connector.
5. Remove Haz/Run/Acc/Misc fuse from upper fuseblock to reset the feedback signal to the HTCM on power up. Wait one minute from power up for the HTCM to reset before turning on the heat pump system.



PSMHVC67532AA



OUTSIDE AIR VALVE ACTUATOR ASSEMBLY



PSMHVC67563AA

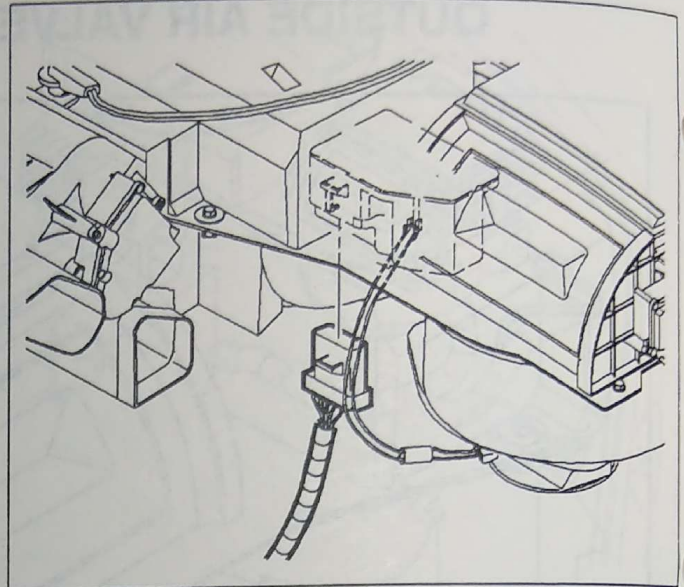
GENERAL DESCRIPTION

The outside air valve actuator is a 12 volt electric motor with a five volt feedback circuit controlled by the HTCM. The outside air valve actuator rotates a door between inside and outside air. When recirculation is activated, the motor allows the air inside the passenger compartment to be drawn back into the heating and A/C module. When recirculation is not activated, fresh outside air is drawn into the system.

BLOWER MOTOR CONTROL MODULE ASSEMBLY

REMOVAL

1. Place keypad on "LOCK" mode.
2. Disconnect blower motor control module electrical connector.
3. Disconnect blower motor electrical connector.



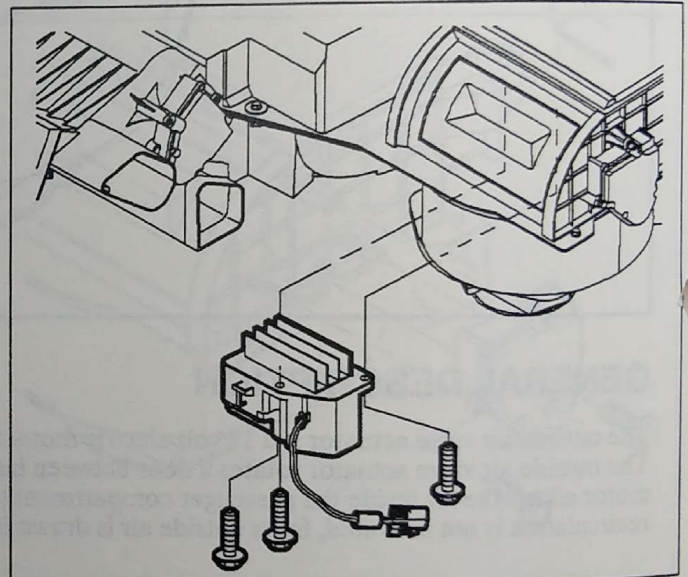
PSMHVC67531AA

4. Remove blower motor control module mounting screws.
5. Remove blower motor control module from heating and A/C module.

INSTALLATION

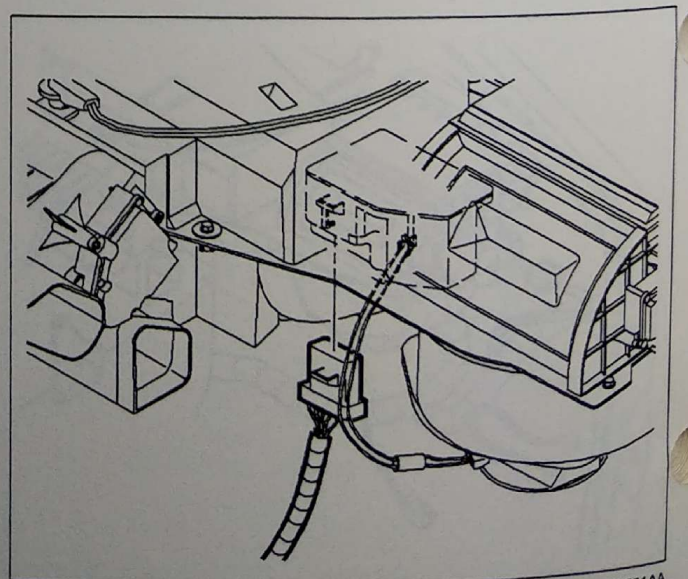
1. Install blower motor control module into heating and A/C module.
2. Install blower motor control module mounting screws.

Torque: 1.5 N•m (13 in-lbs)

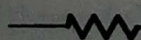


PSMHVC67391AA

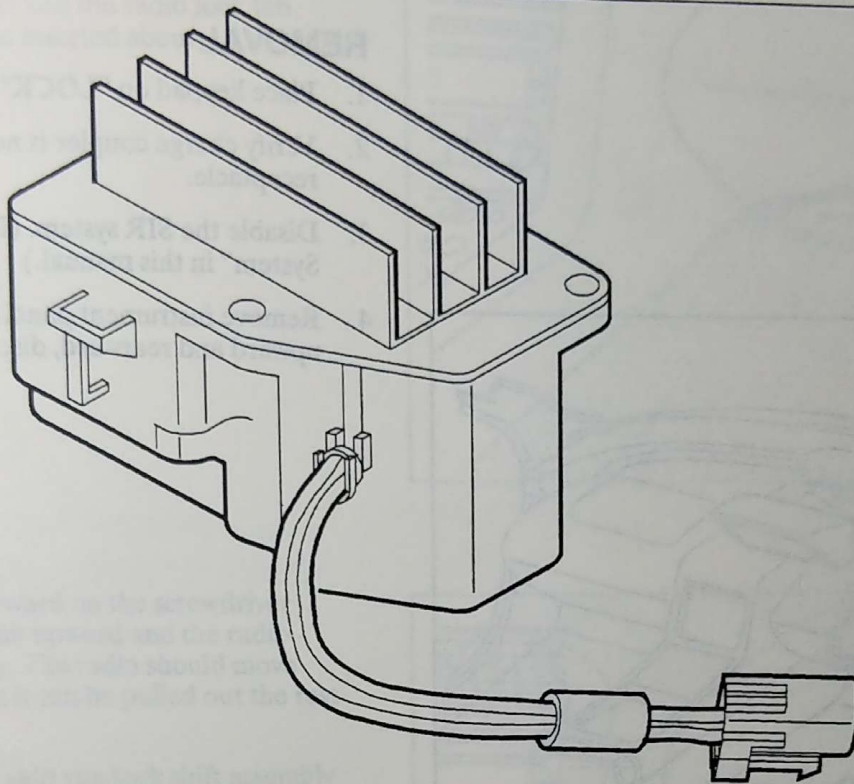
3. Connect blower motor control module electrical connector.
4. Connect blower motor electrical connector.



PSMHVC67531AA



BLOWER MOTOR CONTROL MODULE ASSEMBLY



PSMHVC67562AA

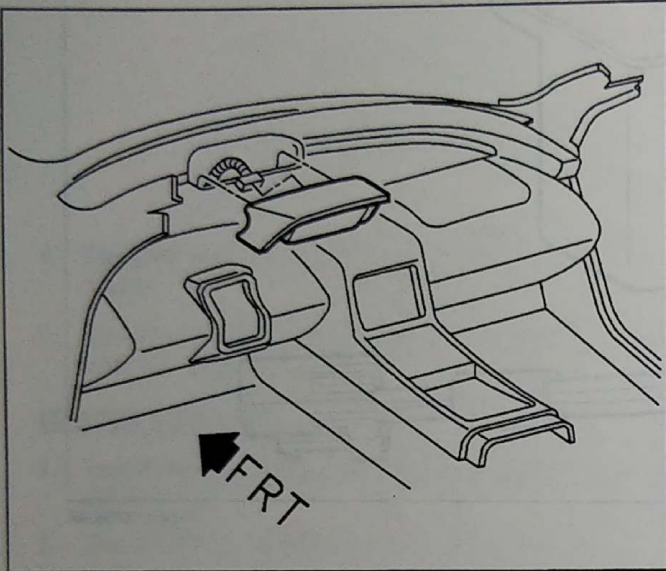
GENERAL DESCRIPTION

The BMCM is a 12 volt electrical device which receives a blower motor speed command from the HTCM and controls the blower motor speed via a pulse width modulated signal.

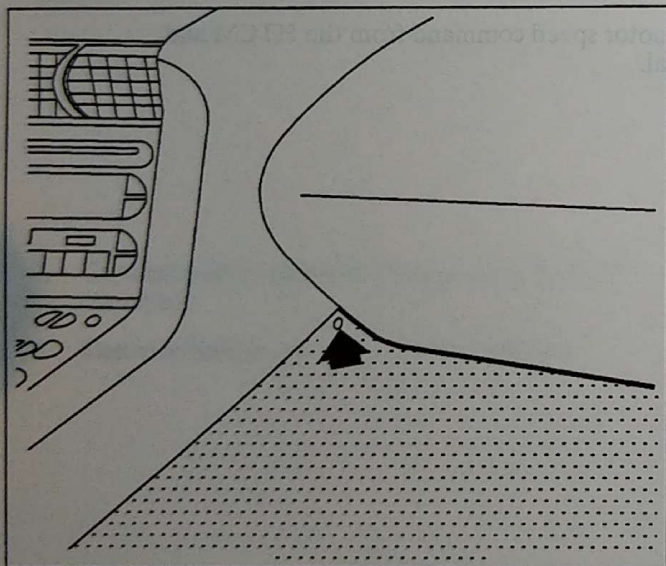
HEAT PUMP VENTILATION MODULE DISCHARGE TEMPERATURE SENSOR ASSEMBLY

REMOVAL

1. Place keypad on "LOCK" mode.
2. Verify charge coupler is not installed in charger receptacle.
3. Disable the SIR system. (Refer to "Disabling the SIR System" in this manual.)
4. Remove instrument panel cluster (IPC) by lifting upward and rearward, disconnect the IPC connector.



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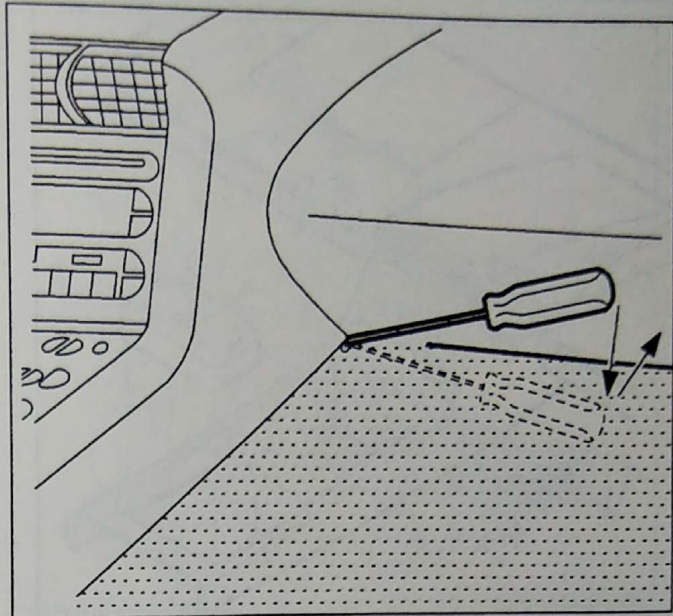


PSMELC66382AA

5. Locate hole in instrument panel tunnel bracket on right side behind carpet.
6. Use a knife to make a small slit in carpet over the hole.

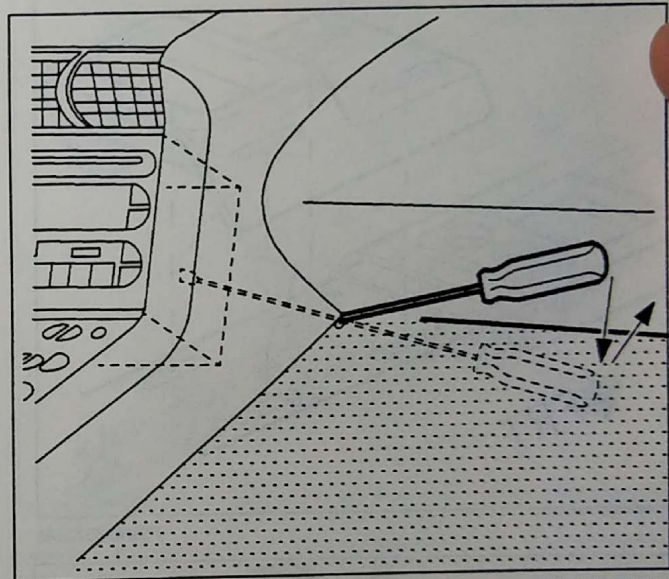


7. Insert a screwdriver with a blade about 152–304 mm (6 in. – 12 in.) long into the hole in the instrument panel tunnel bracket. Slide screwdriver along instrument panel radio bracket until the screwdriver is wedged between bracket and the radio lock tab. The screwdriver should be inserted about 152 mm (6 in.).



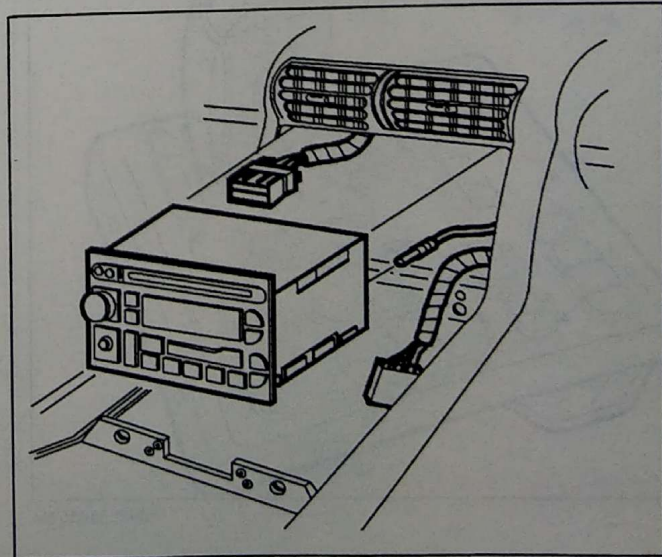
PSMELC66383AA

8. Push downward then forward on the screwdriver handle, lifting the lock tab upward and the radio rearward simultaneously. The radio should move rearward enough so that it can be pulled out the rest of the way by hand.
9. With the brake applied, shift run/lock shift assembly (RSA) to DRIVE, then select ACCY mode to shut Off power and apply the parking brake to keep the vehicle from rolling unexpectedly.
10. Lay a clean shop rag over the RSA to help protect it from getting scratched by the radio case during radio removal.
11. Slide radio out of instrument panel.



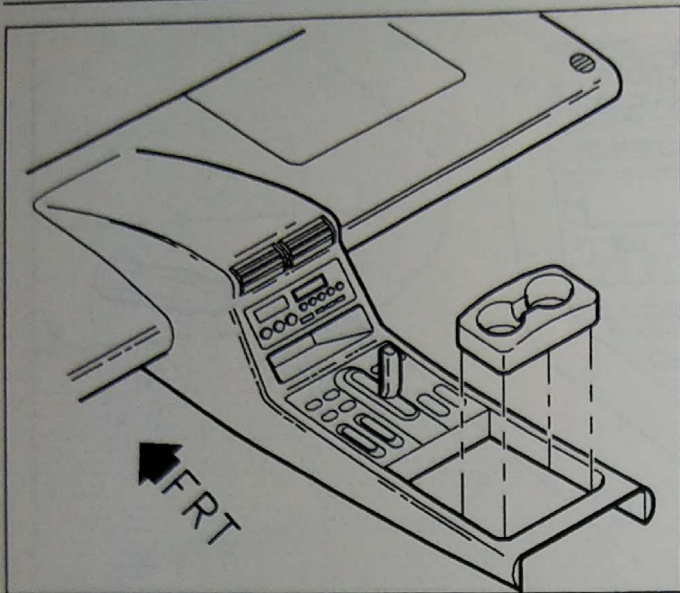
PSMELC66837AA

12. Disconnect the antenna lead first, then the harness connector.
13. With the brake applied, select the RUN mode again, and shift back to PARK. Then select the lock mode to turn the vehicle Off.



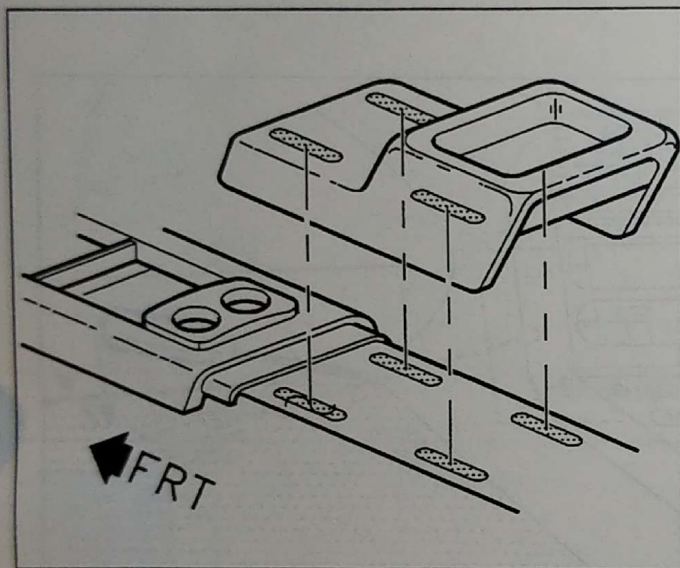
PSMELC65847AA

14. Remove cup holder.



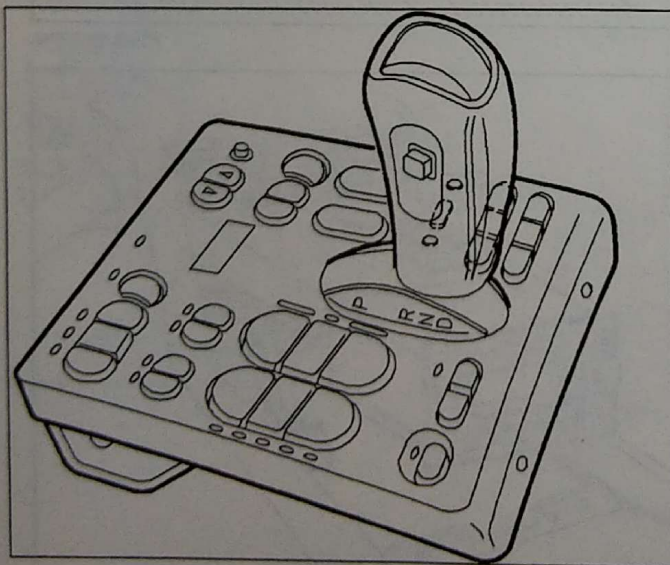
PSMMS65734AA

15. Remove arm rest from tunnel by lifting upward releasing Dual-Lock retainers.



PSMMS65735AA

16. Remove the T-25 TORX™ screws in the rear of the RSA, pull RSA rearward about 63 mm (2.5 in.).



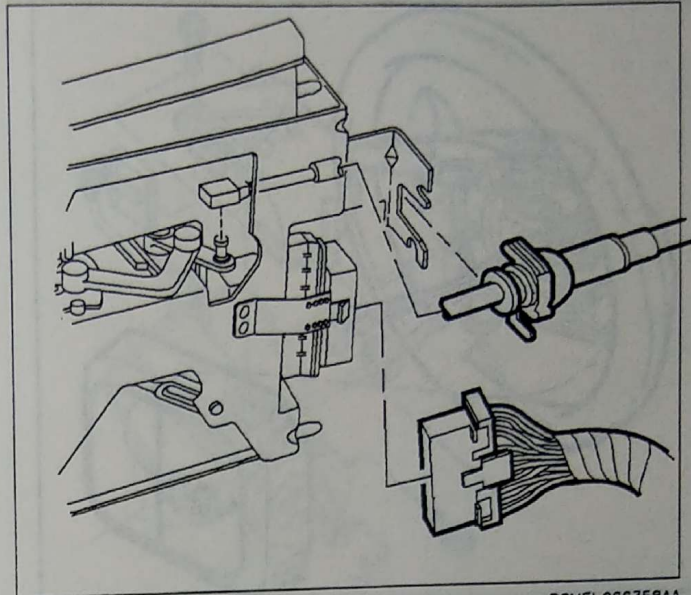
PSMELC66357AA



17. Rotate RSA towards the drivers side of the vehicle to a 45 degree angle.

18. Disconnect the RSA wire harness connector.

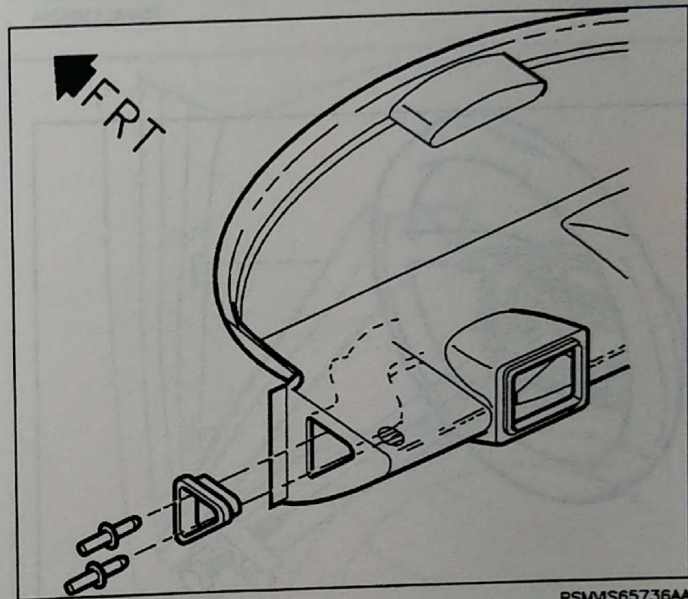
19. Disconnect the shift cable from the shifter and remove shift cable from retainer bracket by prying locking tab on drivers side of RSA gently and pushing cable down out of bracket.



PSMELC66358AA

20. Drill out rivets from side door air outlets.

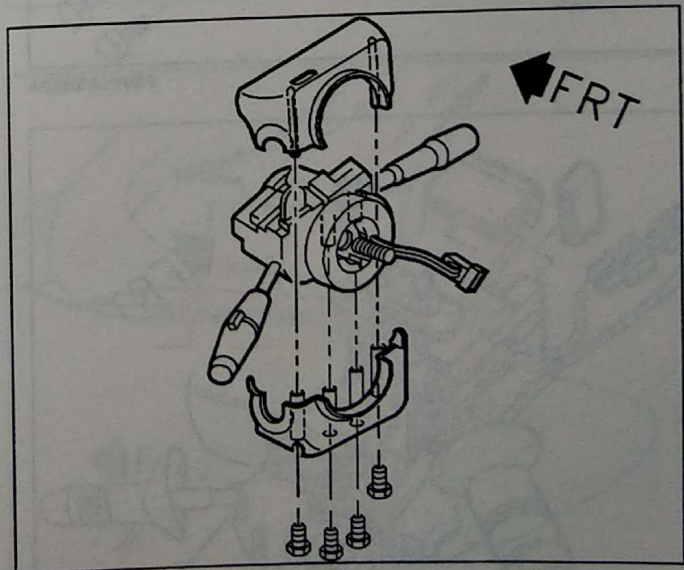
21. Remove left and right front side door air outlets on the side of instrument panel with doors open.



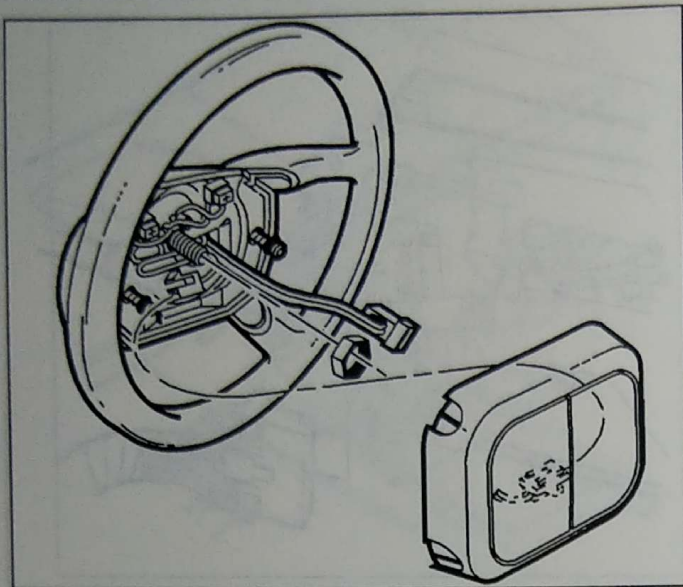
PSMMS65736AA

22. Remove outer screws from lower steering column trim cover, lift upper trim panel off.

23. Remove inner screws from lower steering column trim cover and remove lower trim cover.

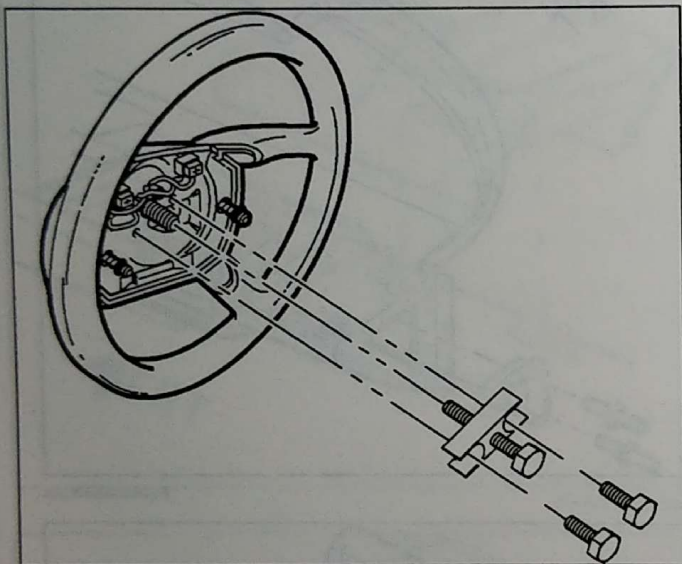


PSMMS65827AA



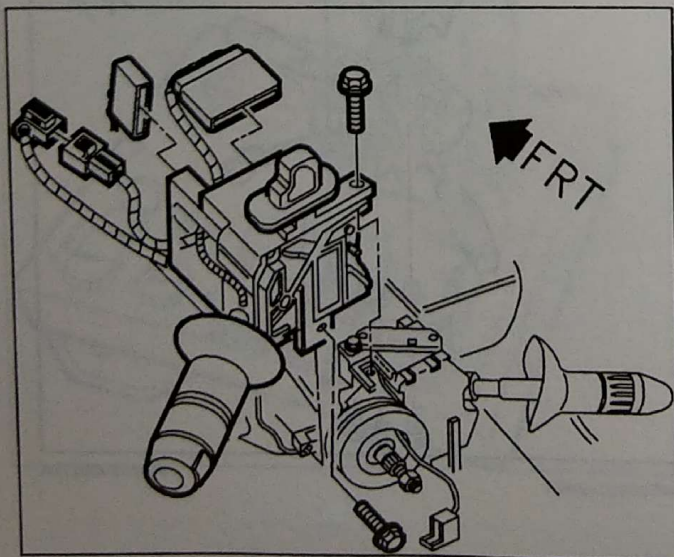
PSMVIS65863AA

24. Remove screws from back of steering wheel that retains SIR inflator module.
25. Remove connector position assurance (CPA) and disconnect inflator module connector.
26. Remove SIR inflator module.



PSMVIS65862AA

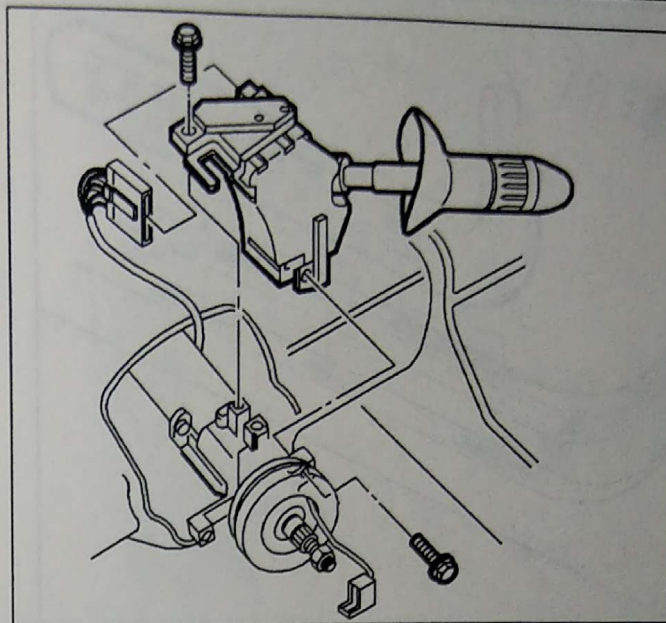
27. Disconnect horn switch connector.
28. Remove nut from steering column that retains steering wheel.
29. Install steering wheel puller SA9218NE and remove steering wheel.



PSMELC66355AA

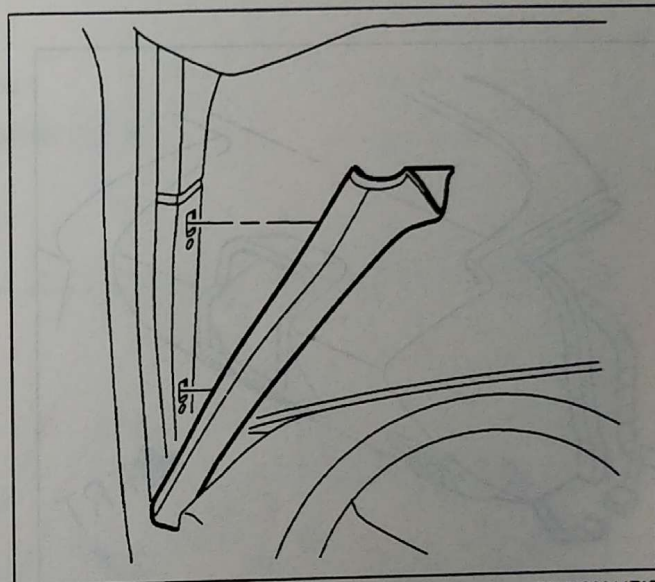
30. Remove T-25 TORX™ /7mm screws from turn signal, headlamp, and cruise switch.
31. Remove switch and disconnect switch connectors.

32. Remove T-25 TORX™ /7mm screws from windshield washer switch.
33. Disconnect connector and remove switch.



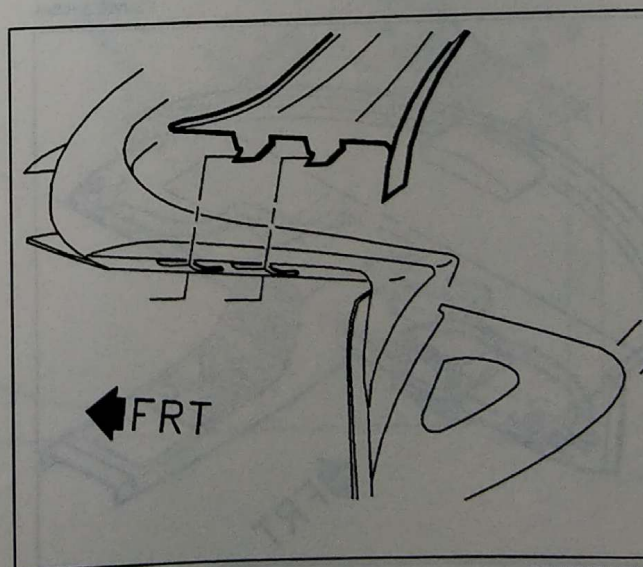
PSMELC66356AA

34. Starting at top of garnish molding, pull firmly at clip locations to disengage. Tipping the top of molding inward with the bottom engaged to instrument.

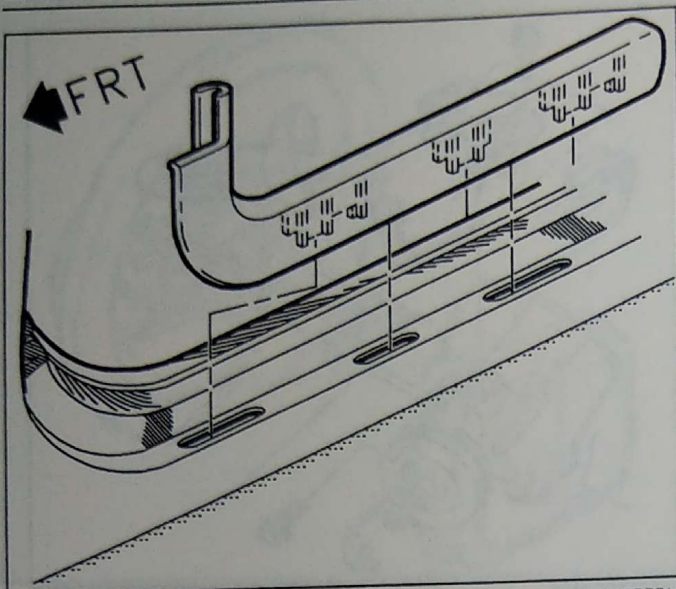


PSMMS66447AB

35. Disengage tabs on garnish molding from instrument panel by pulling rearward and inboard.

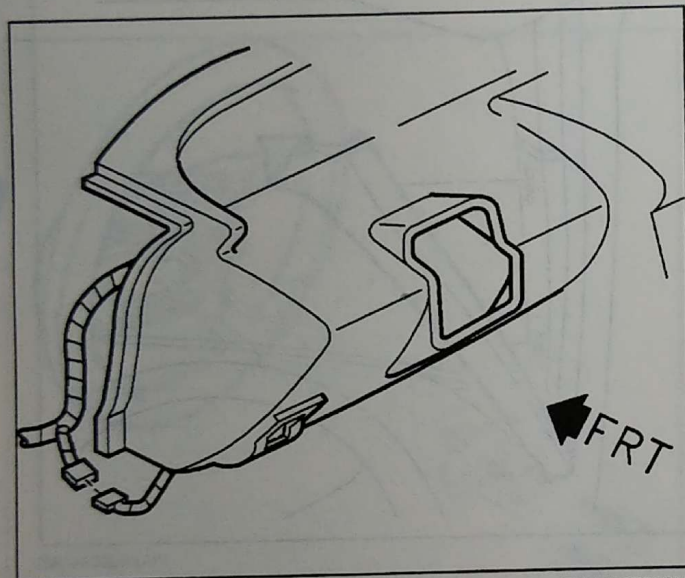


PSMMS66448AA



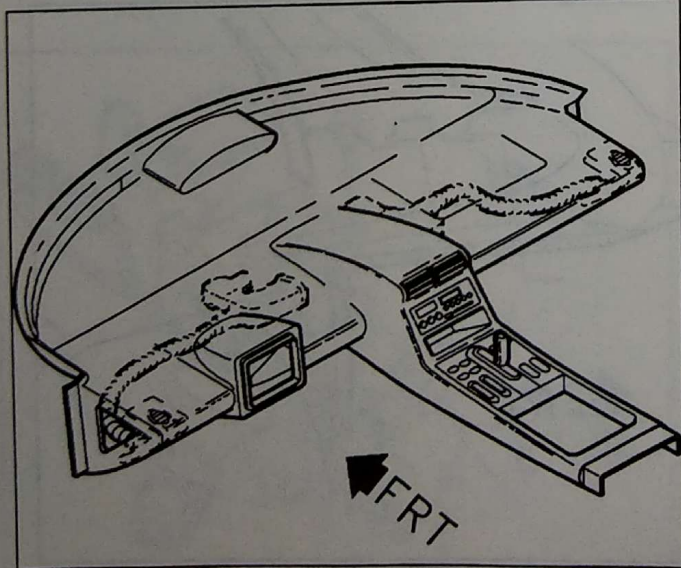
PSMVIS65733AA

36. Starting at rear of carpet retainer, pull firmly on carpet retainer at clip locations to disengage clips.
37. Remove front side door opening floor carpet retainer.



PSMVIS65865AA

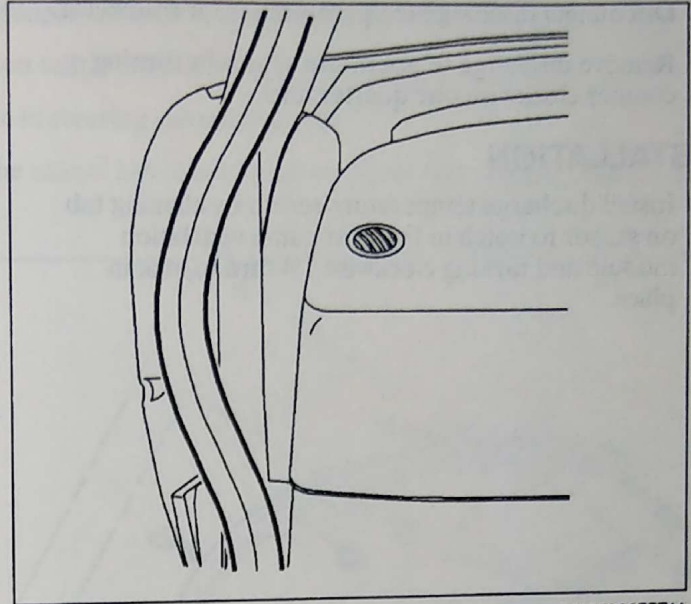
38. Disconnect parking brake switch connector.



PSMVIS66047AA

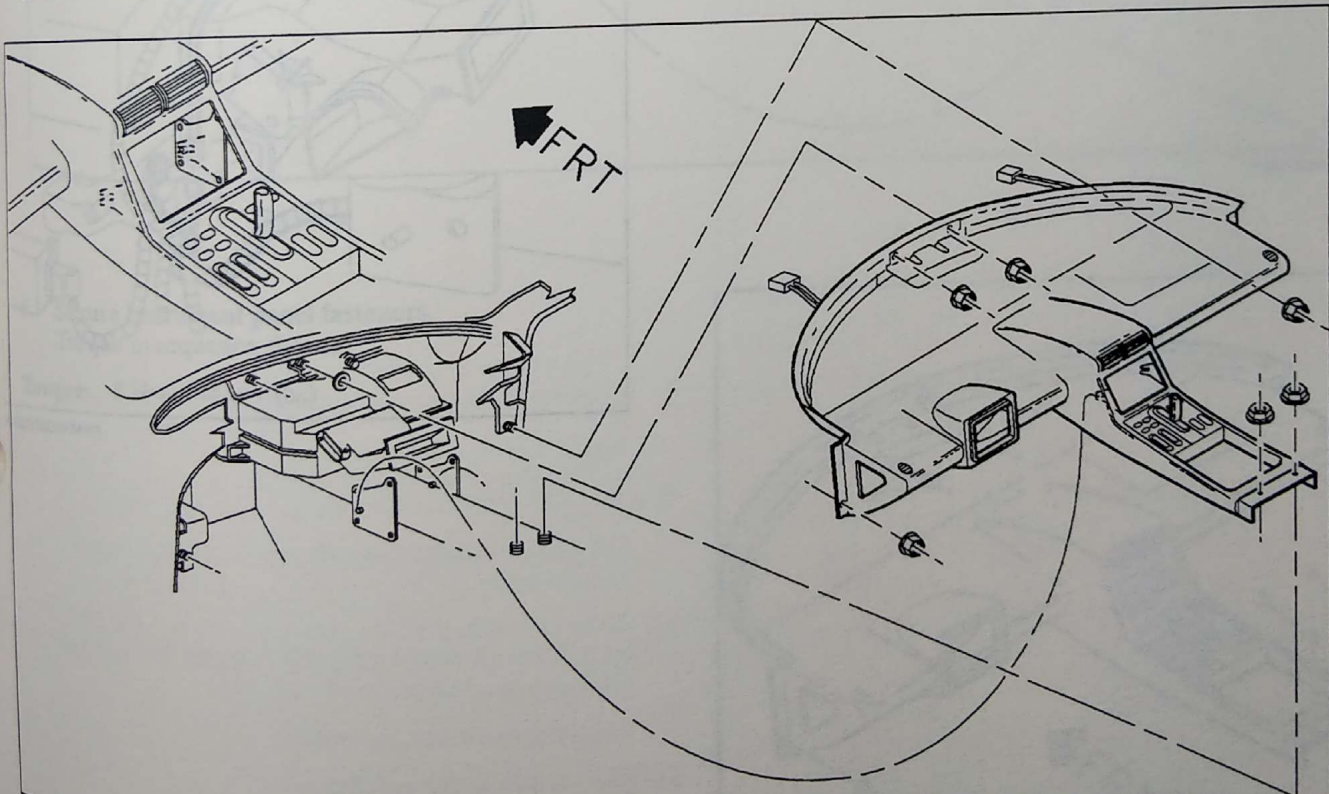
39. Disconnect side window demistor tubes from floor outlets.

40. Remove side door weatherstrip from pinch weld flange near instrument panel.



PSMVIS66337AA

41. Remove retainers from instrument panel.
42. Pull instrument panel rearward with slight upward pressure.
43. Pull driver's side demister tube through hole in steering column support
44. Disconnect both information telltale connectors.
45. Remove instrument panel from vehicle.

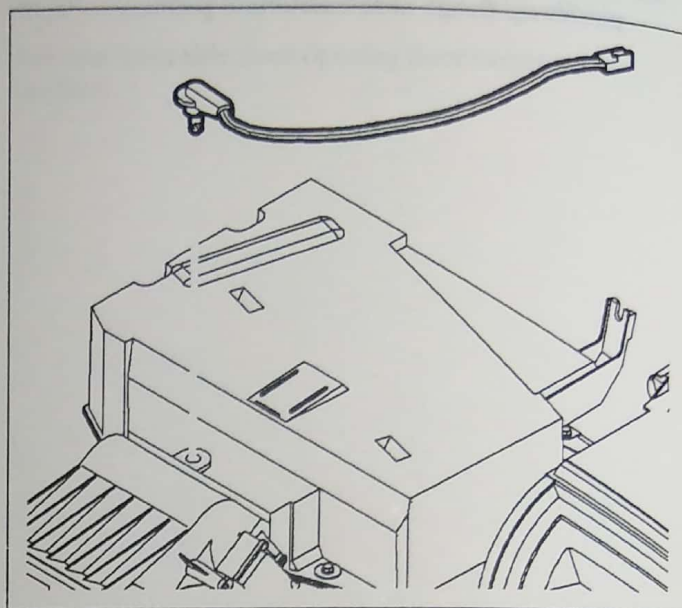


PSMVIS66048AA

46. Disconnect discharge temperature sensor connector.
47. Remove discharge temperature sensor by turning counter clockwise one quarter turn.

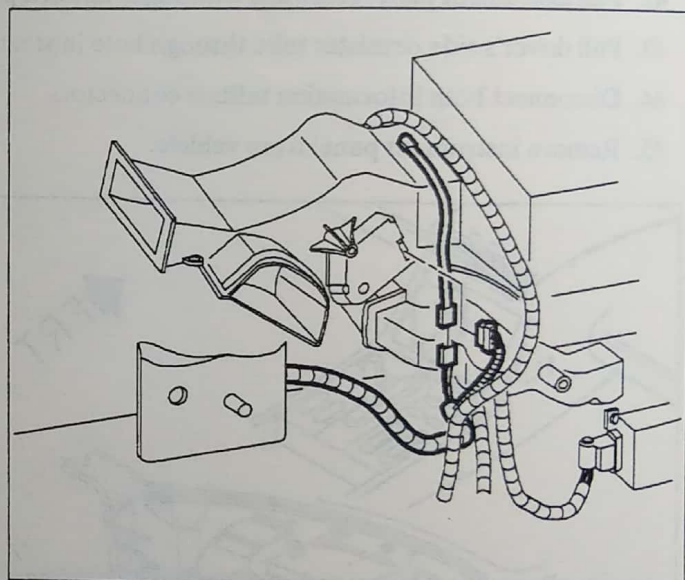
INSTALLATION

1. Install discharge temperature sensor by aligning tab on sensor to notch in the heat pump venalation module and turning clockwise 1/4 turn to lock in place.

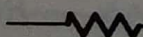


PSMHVC67395AA

2. Connect discharge temperature sensor connector.

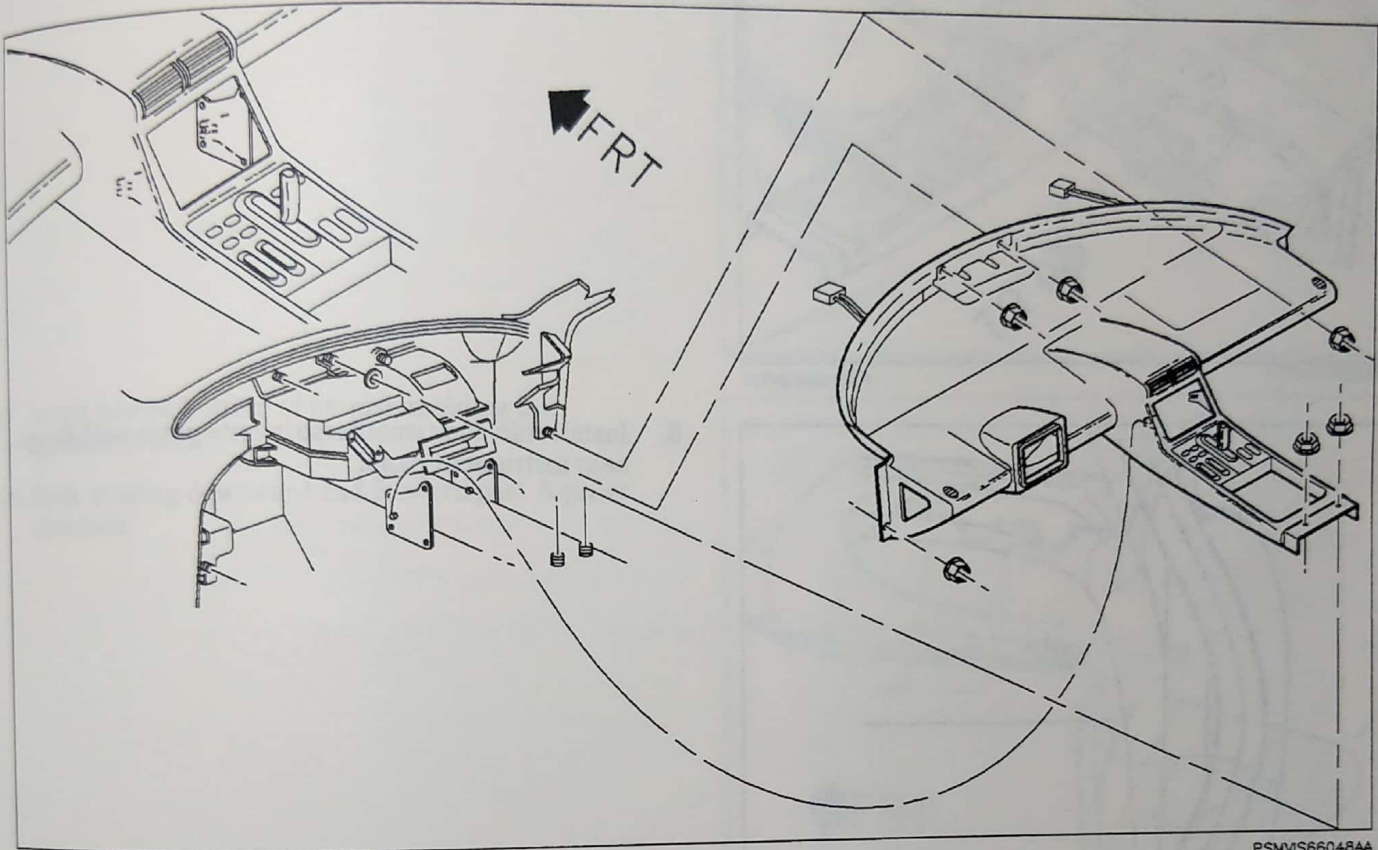


PSMHVC67533AA



IMPORTANT: Before assembling make sure spacer is in proper location to body. Refer to illustration.

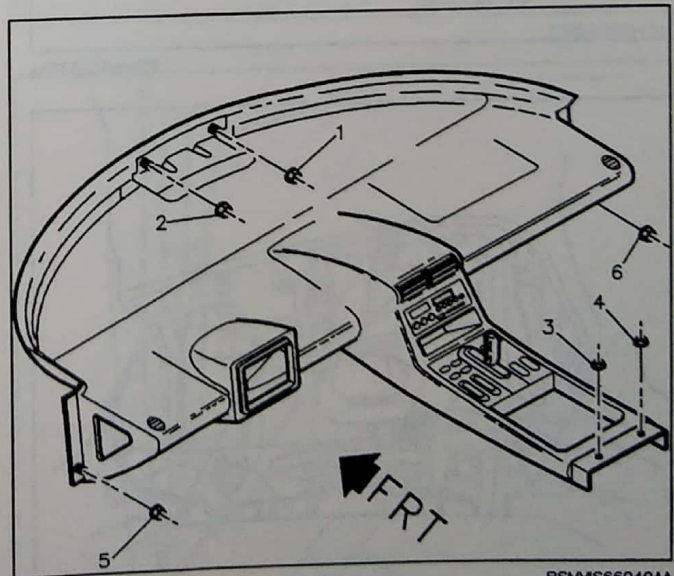
3. Set instrument panel in location and connect information telltale connectors.
4. Guide driver's side demister tube into and through hole in steering column support.
5. Install instrument panel over studs on front of dash. The tunnel has locator pins on either side of which the instrument panel has to be located on when installing.



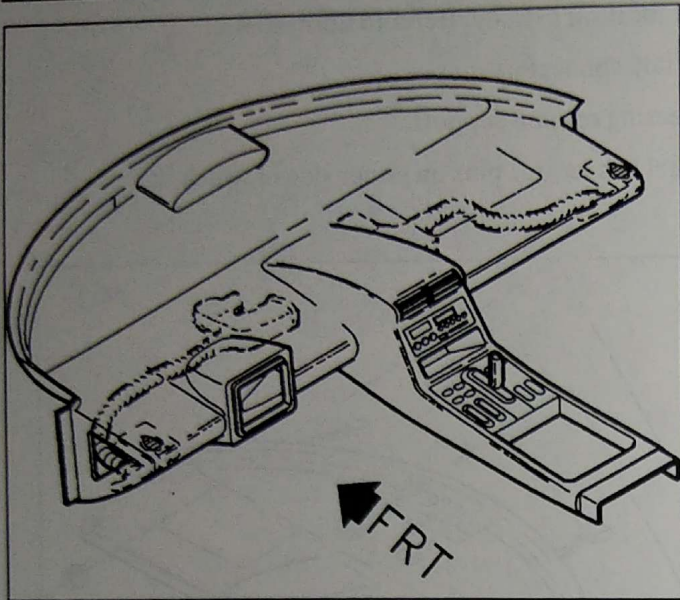
PSMVIS66048AA

6. Secure instrument panel fasteners.
Torque in sequence shown.

Torque: 5 N•m (44 in-lbs)

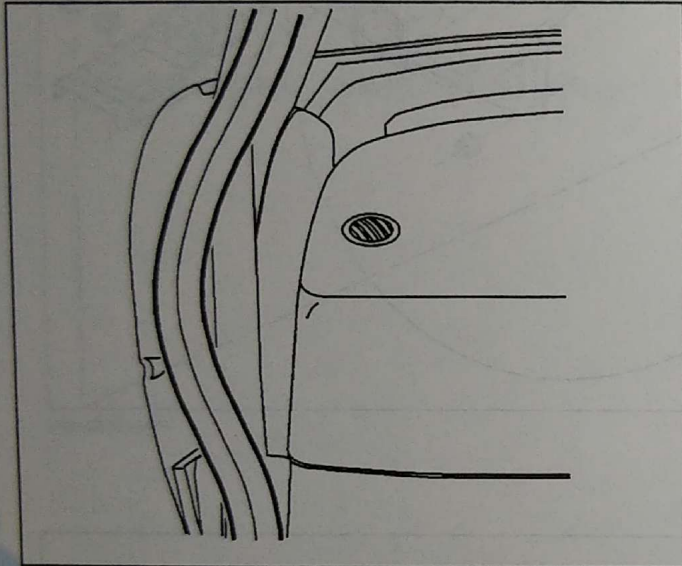


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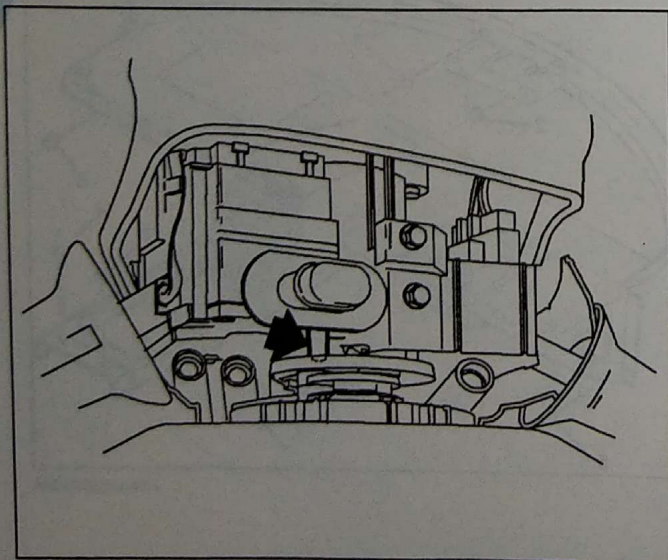
PSMVIS66047AA

7. Connect side window demister tubes to floor outlets.



PSMVIS66337AA

8. Install side door weatherstrip onto pinch weld flange near instrument panel.



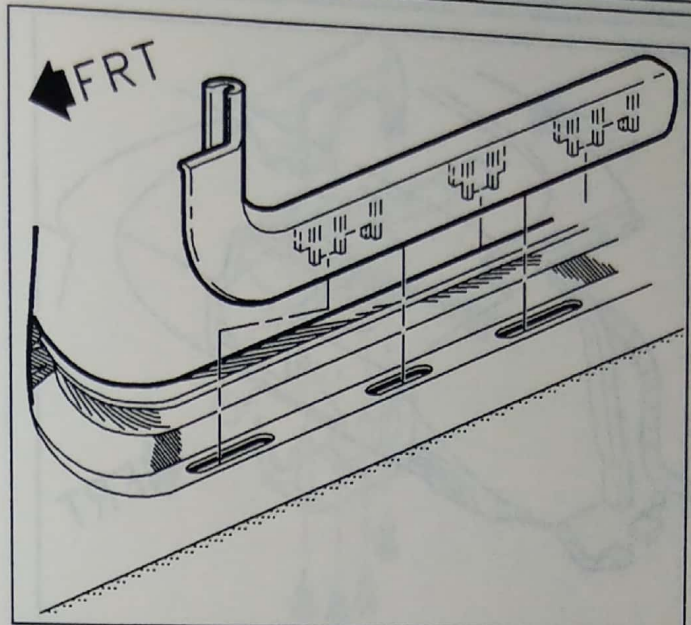
PSMELC66439AA

9. Connect connector to windshield washer switch.
10. Install screws retaining switch.
11. Connect connectors to turn signal, headlamp, and cruise switch.
12. Place switch in position, being careful that the pin is positioned correctly against the ring on the back of the turn signal cancel cam assembly.
13. Install screws retaining switch.

Torque: 2.5 N•m (22 in-lbs)

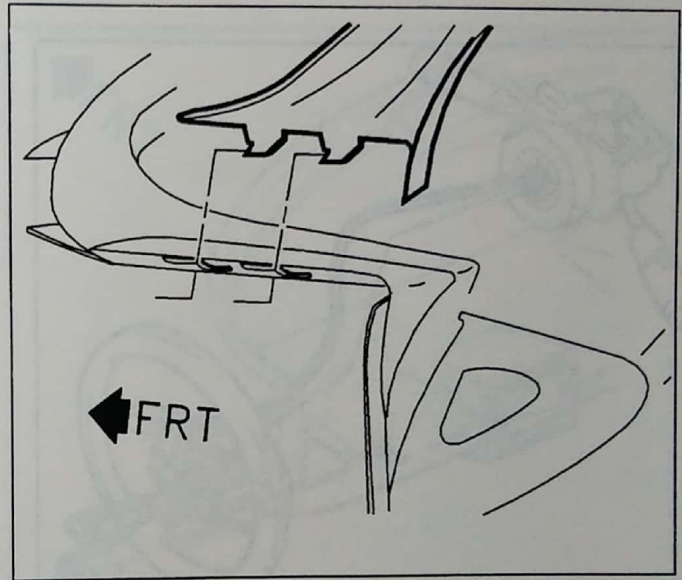


14. Locate carpet retainer to door opening.
15. Firmly seat carpet retainer into weather.
16. Snap clips into slots in inner rocker pan.



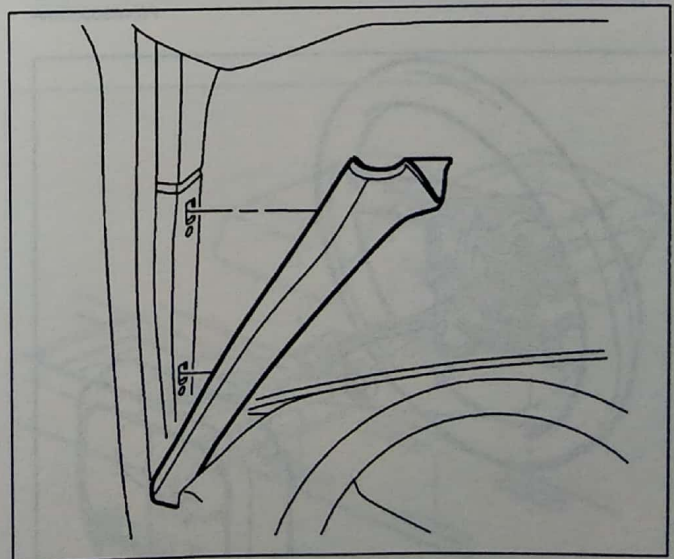
PSMMS65733AA

17. Insert tabs on bottom of garnish molding into instrument panel.
18. Push molding downward and forward past A-pillar structure.



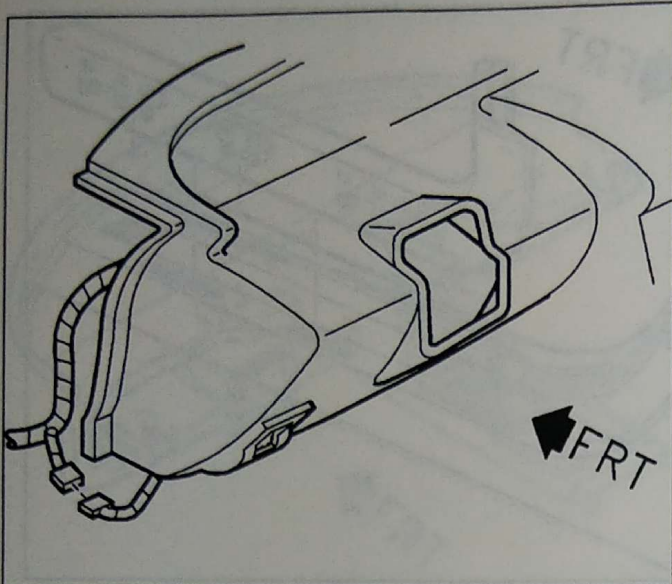
PSMMS66448AA

19. Push molding to structure pressing forward and outward to insure proper fit to instrument panel, headlining and door seal.
20. Align clips on garnish molding to slots in A-pillar and press firmly at clip locations.
21. Position flap on door weatherstrip over windshield garnish molding.



PSMMS66447AB

22. Connect park brake switch connector.



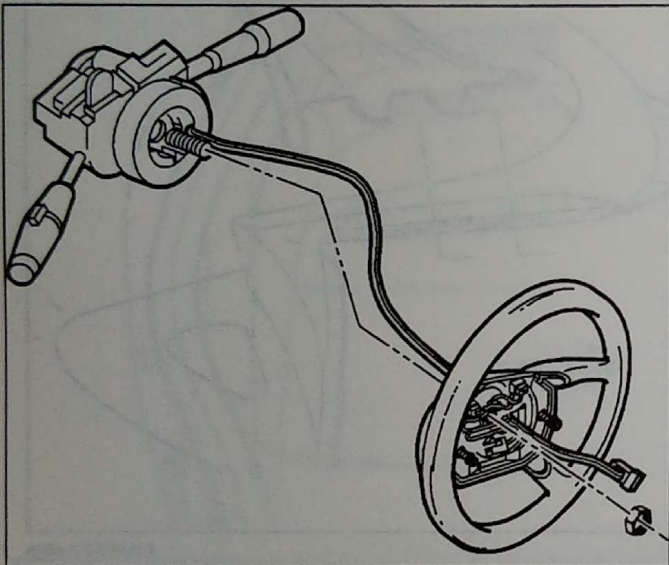
PSMVIS65865AA

23. Route SIR cable through steering wheel. Install steering wheel to column.

24. Connect horn wire connector.

25. Install steering wheel nut.

Torque: 42 N•m (31 ft–lbs)



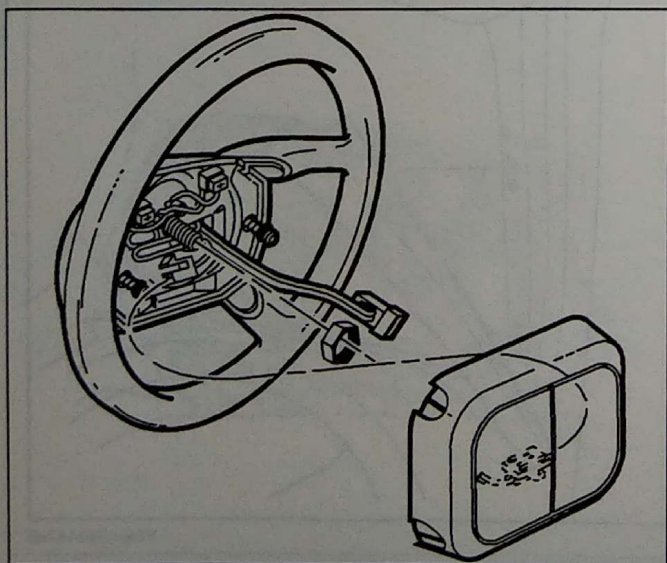
PSMVIS65864AA

26. Route yellow SIR inflator module wire harness within the steering wheel hub forming an "S" shape with wire and connect SIR inflator module connector.

27. Install CPA, to connector.

28. Install inflator module to steering wheel.

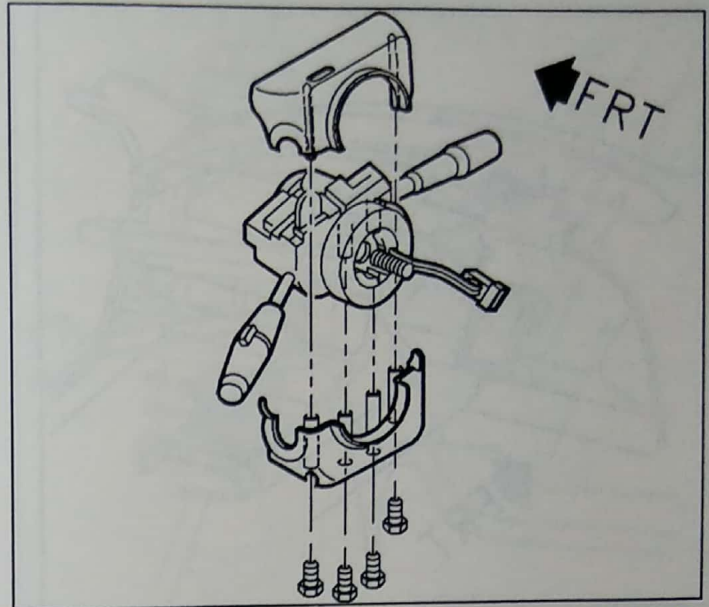
Torque: 10 N•m (89 in–lbs)



PSMVIS65863AA

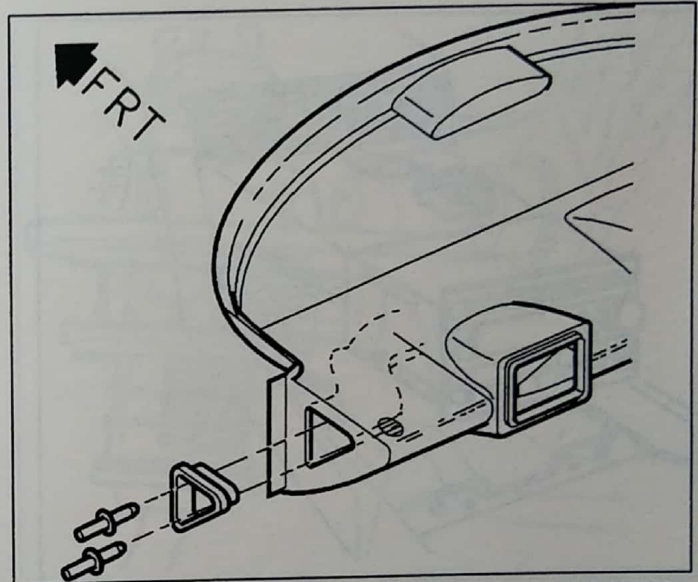


29. Align lower steering column trim cover to steering column. Install and tighten inner screws.
30. Align upper steering column trim panel to steering column and install outer screws in lower steering column trim panel. Tighten outer screws.



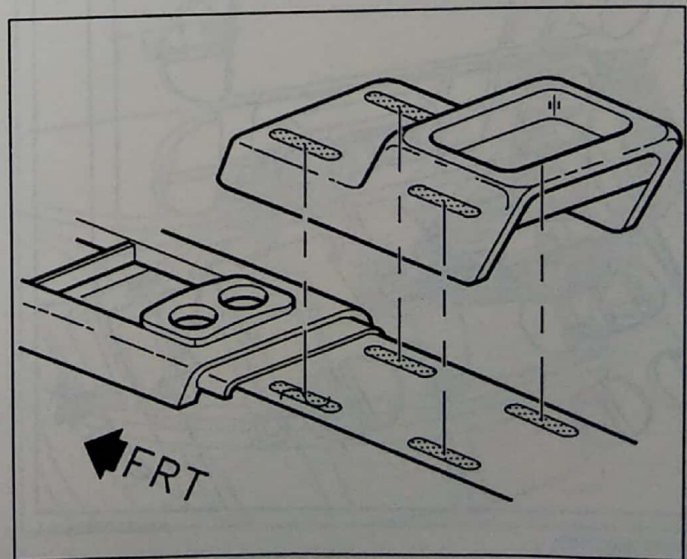
PSMVS65827AA

31. Install left and right front side door air outlets on side of the instrument panel using new fasteners.

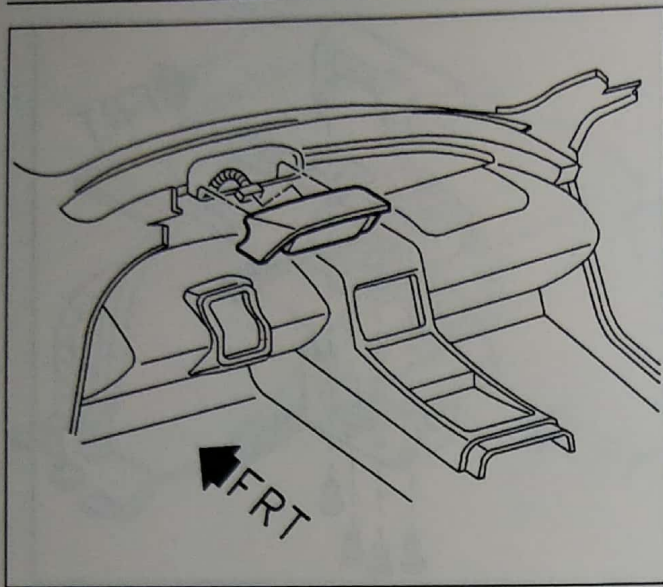


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32. Install arm rest

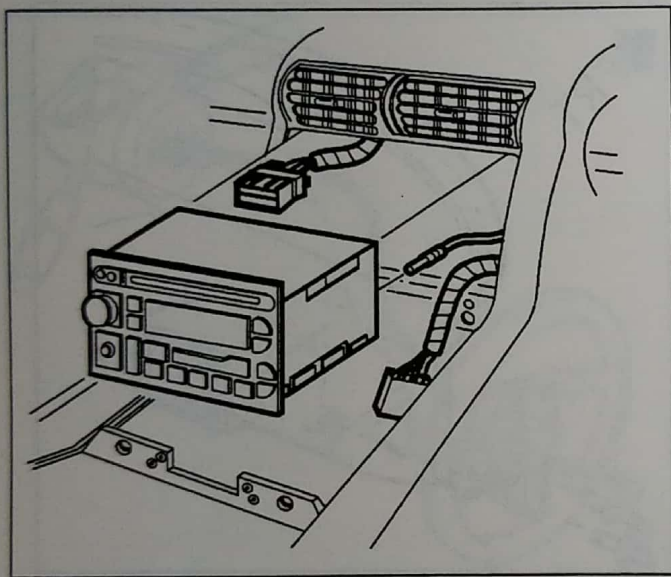


PSMVS65735AA



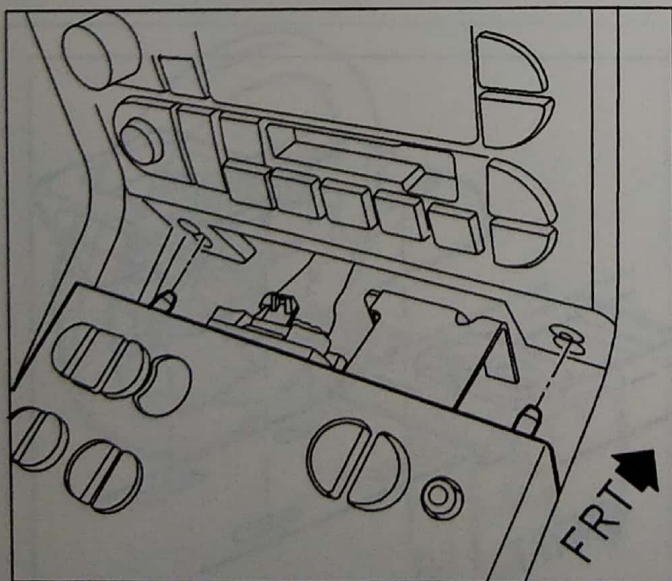
PSMELC66359AA

33. Push harness connector into socket on instrument panel cluster. Verify connection is made, seated and locked.
34. Install instrument panel cluster into instrument panel by pushing forward and downward.



PSMELC65847AA

35. Connect radio harness to radio, then antenna lead to radio. Verify both connections are seated properly.
36. Make sure antenna and harness are up and out of the way of the radio bracket. Slide radio into opening until the radio is seated and the radio fits tightly to the console. You may hear a click as the radio tab locks into the bracket.



PSMELC66360AA

37. Cover the radio face with a rag for protection during RSA installation. Install shift cable housing into shift bracket and connect and secure shift cable to shifter. Be sure clip lock tab is in place.
38. Connect wire harness connector to RSA.
39. Align RSA locator tabs to front of instrument panel and push down on the rear of the RSA.
40. Install TORX™ fasteners.

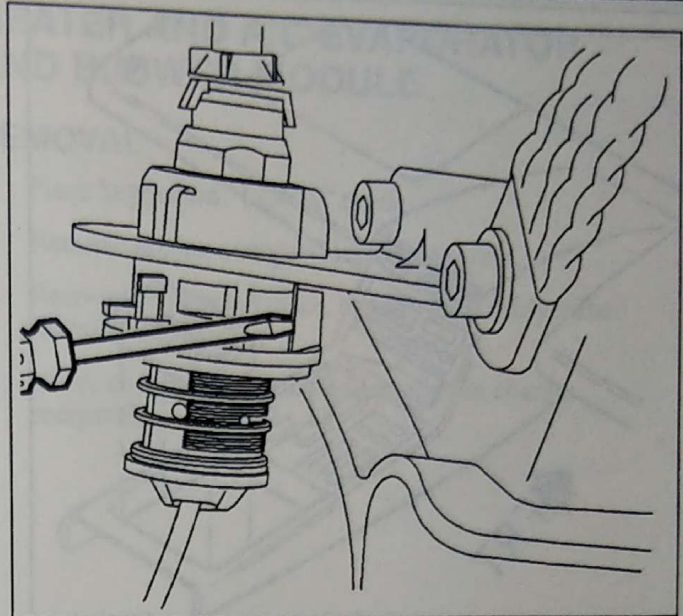
Torque: 6 N•m (53 in-lbs)

IMPORTANT: You must adjust shift cable at final drive unit.

41. Adjust shift cable:

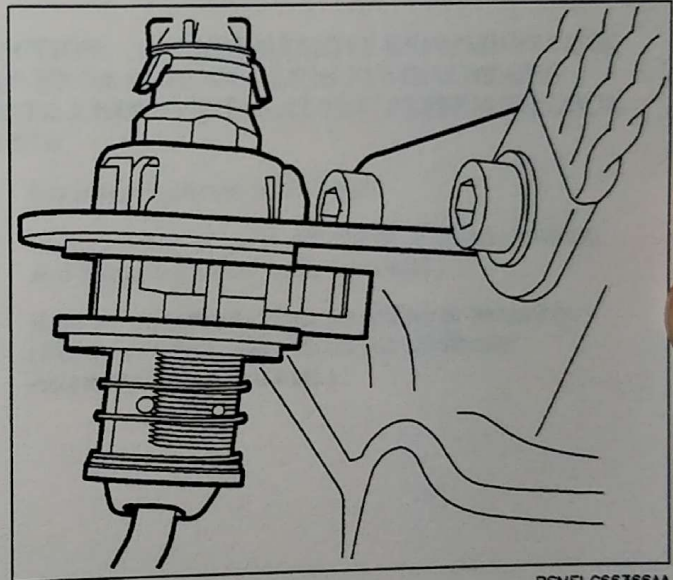
IMPORTANT: The shift cable must be attached to the RSA with the RSA secured in position. Shift handle must be placed in neutral before cable adjustment is performed.

- a. Remove underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" in this manual.)
- b. Unlock U-shaped adjustment collar. Collar is located aft of drive unit bracket, and will unlock by inserting a pocket screwdriver into gap and prying towards drive unit.



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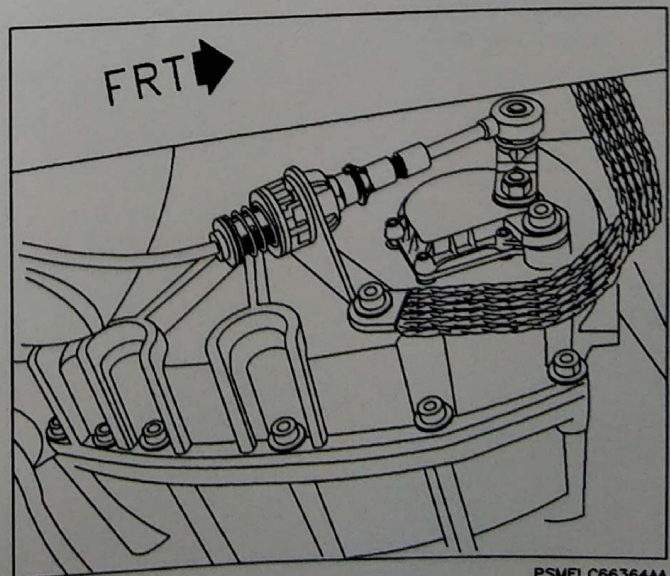
IMPORTANT: About 13 mm (1/2 in.) movement necessary to insure unlock position.



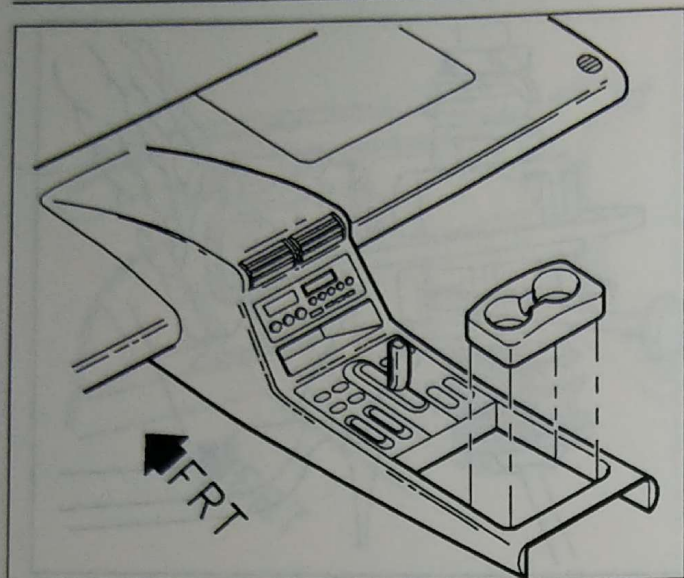
PSMELC66366AA

- c. Verify shift lever is in neutral. Push U-shaped collar into lock position. Collar will move to right side of vehicle.
- d. By hand shift park/lock lever to the full counterclockwise position (DRIVE) then move one detent in the clockwise direction (NEUTRAL).
- e. Install underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" in this manual.)

NOTICE: If shift cable has been removed more than six times at either end, for any reason, the cable must be replaced.



PSMELC66364AA



PSMVS65734AA

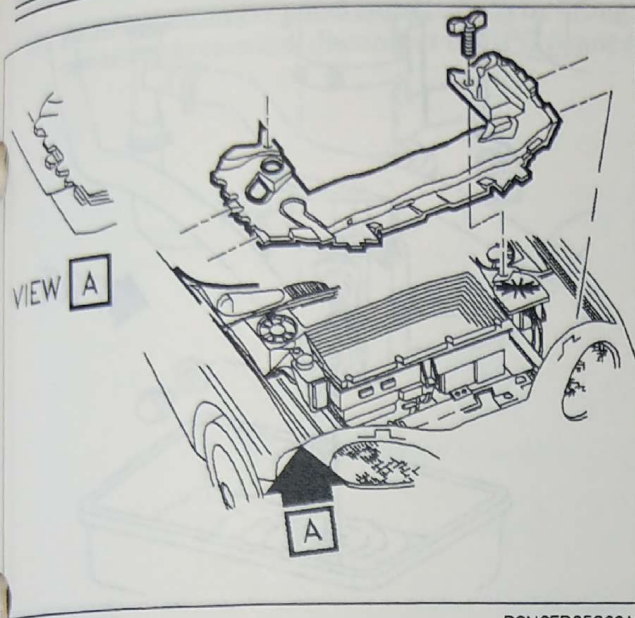
42. Install cup holder to center console.
43. Enable the SIR system. (Refer to "Enabling the SIR System" in this manual.)



HEATER AND A/C EVAPORATOR AND BLOWER MODULE

REMOVAL

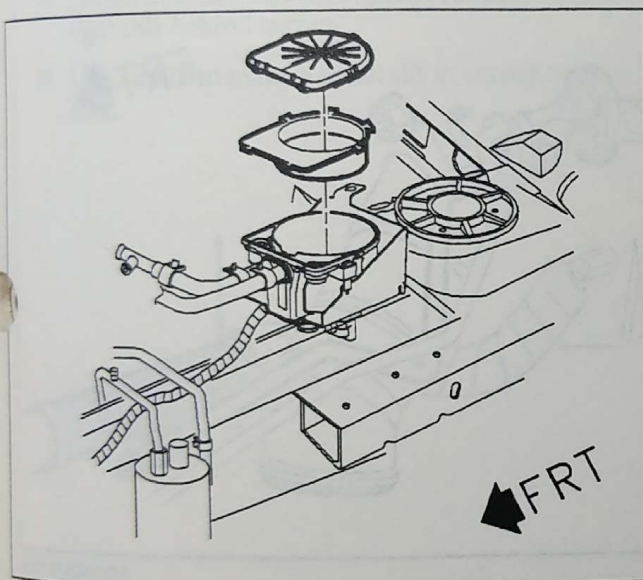
1. Place keypad on "LOCK" mode.
2. Remove engine compartment sight shield.
3. Recover refrigerant using an approved refrigerant recovery system.
4. Verify charge coupler is not installed in charger receptacle.



PSMGEP65869AC

CAUTION: DO NOT REMOVE EXPANSION TANK COVER OR OPEN COOLING SYSTEM DRAINS FROM A HOT SYSTEM. ALLOW SYSTEM TO COOL FIRST.

5. Remove expansion tank cover.
6. Raise vehicle on hoist. (Refer to "Lifting, Jacking, and Support Points" in this manual.)
7. Remove underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" in this manual.)



PSMPEN66720AA

Heating, Ventilating, Air Conditioning and Controls

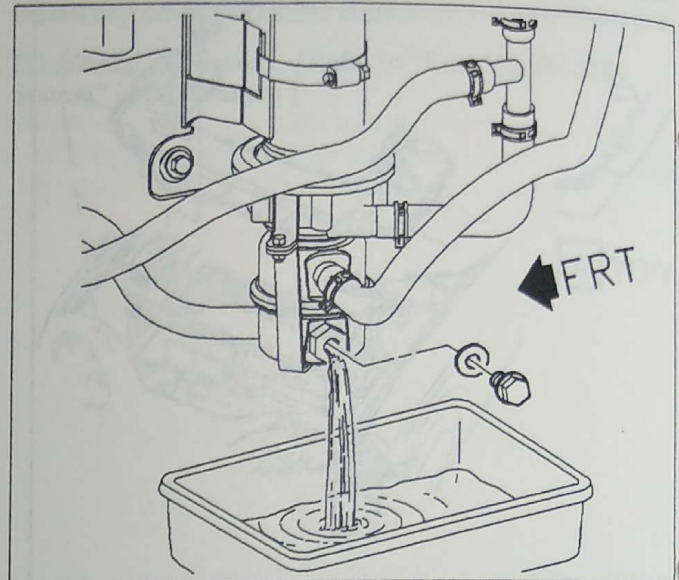
8. Position drain pan under water pump manifold.

IMPORTANT: A two gallon container will be required to hold the coolant.

9. Remove drain plug and gasket from the water pump manifold allow coolant to flow from the main path.
10. After coolant has drained from the main path reinstall water pump manifold drain plug and gasket.

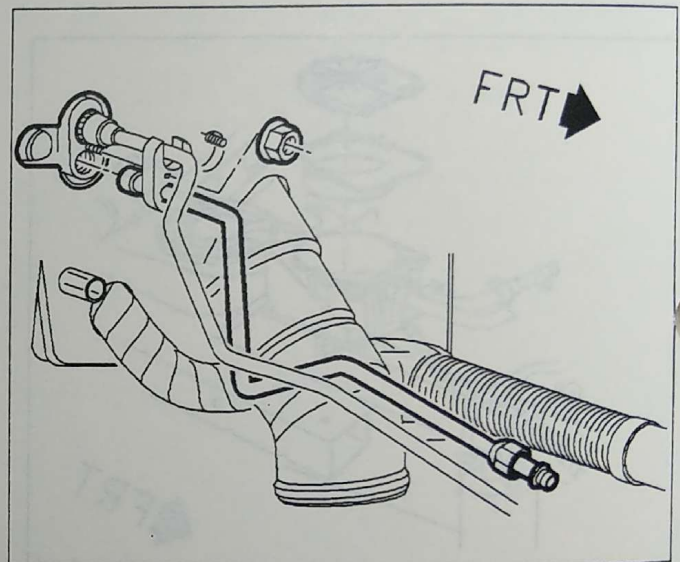
Torque: 11 N•m (97 in-lb)

11. Install underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" in this manual.)



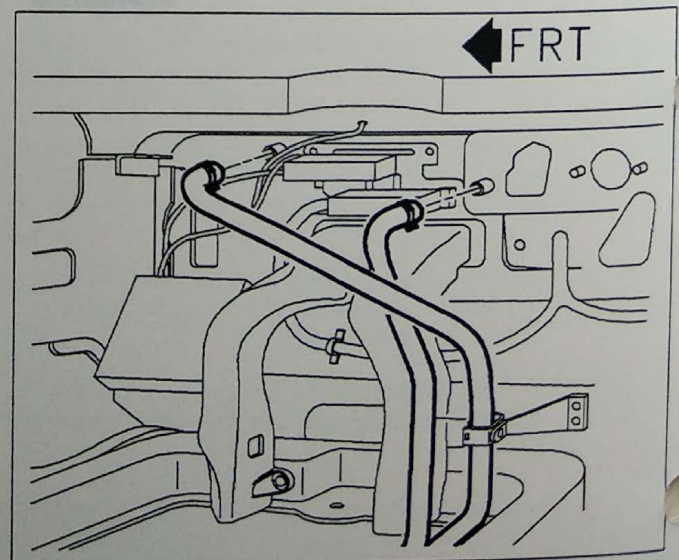
PSMPEN66458A3

12. Lower vehicle on hoist.
13. Remove nut retaining tube at front of dash.
14. Disconnect evaporator tube from evaporator.
15. Disconnect condenser tube from evaporator.



PSMHVC66802A4

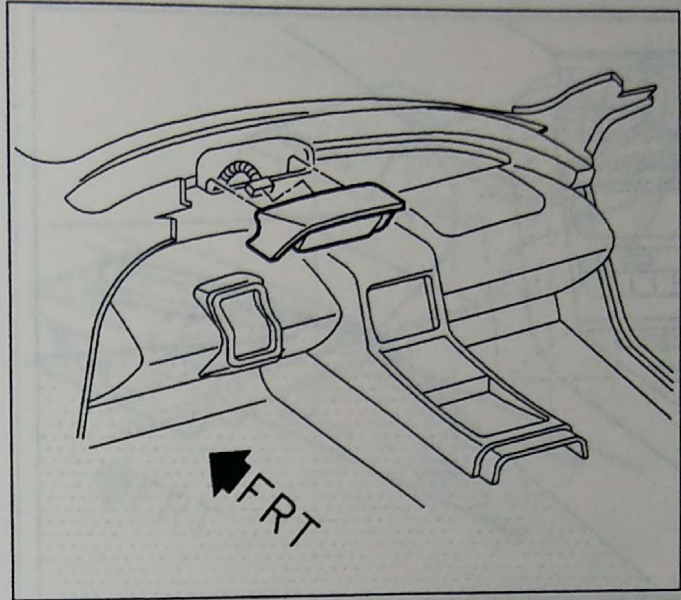
16. Disconnect heater core inlet and outlet hoses from heater core at front of dash.



PSMHVC67534A4

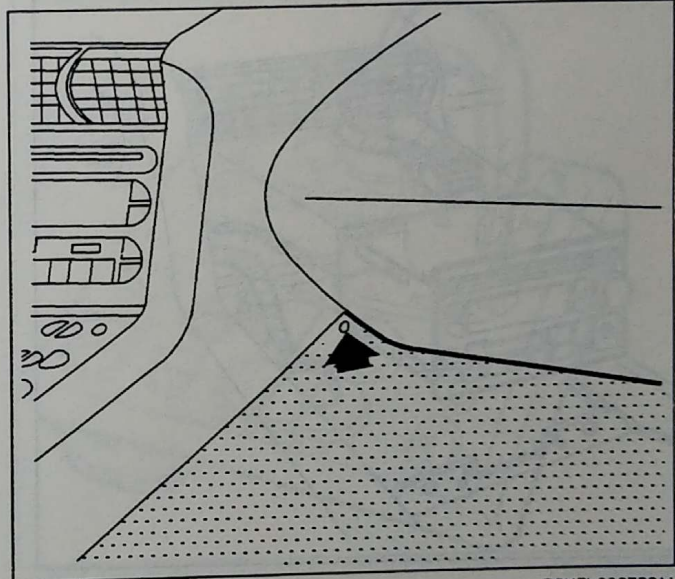


17. Remove instrument panel cluster (IPC) by lifting upward and rearward, disconnect the IPC connector.



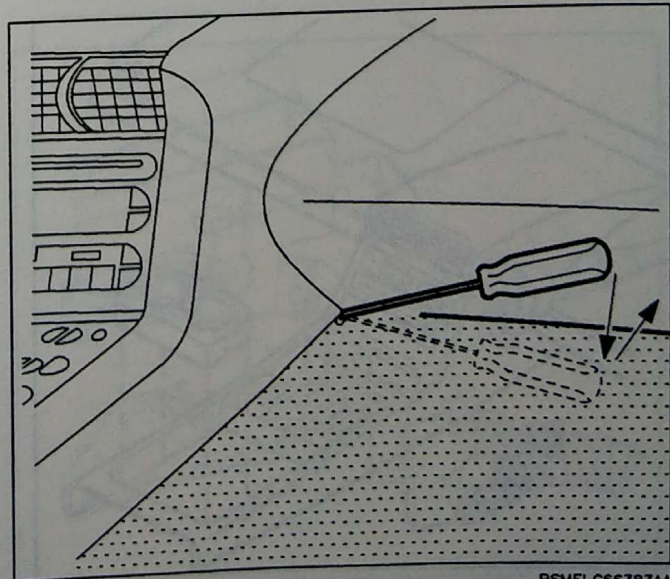
PSMELC66359AA

18. Locate hole in instrument panel tunnel bracket on right side behind carpet.
19. Use a knife to make a small slit in carpet over the hole.

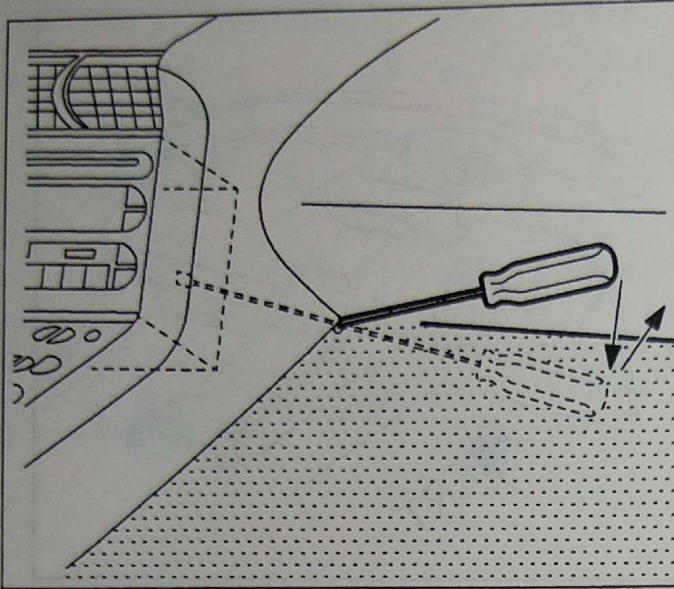


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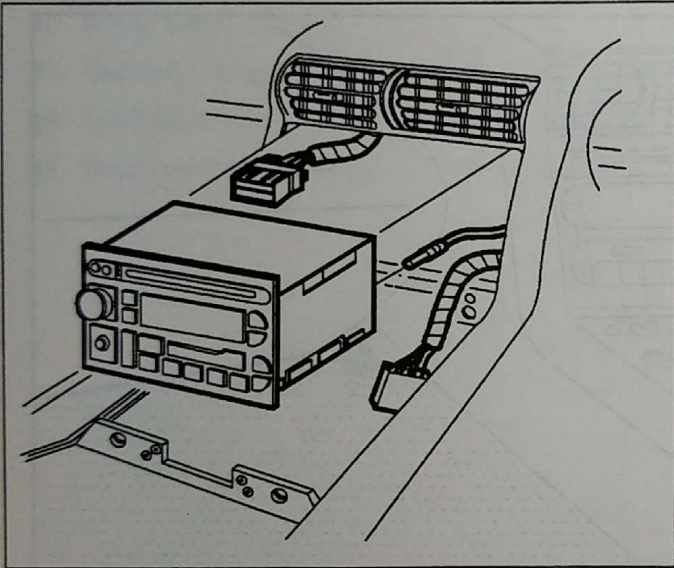
20. Insert a screwdriver with a blade about 152–304 mm (6 in.–12 in.) long into the hole in the instrument panel tunnel bracket. Slide screwdriver along instrument panel radio bracket until the screwdriver is wedged between bracket and the radio lock tab. The screwdriver should be inserted about 152 mm (6 in.).



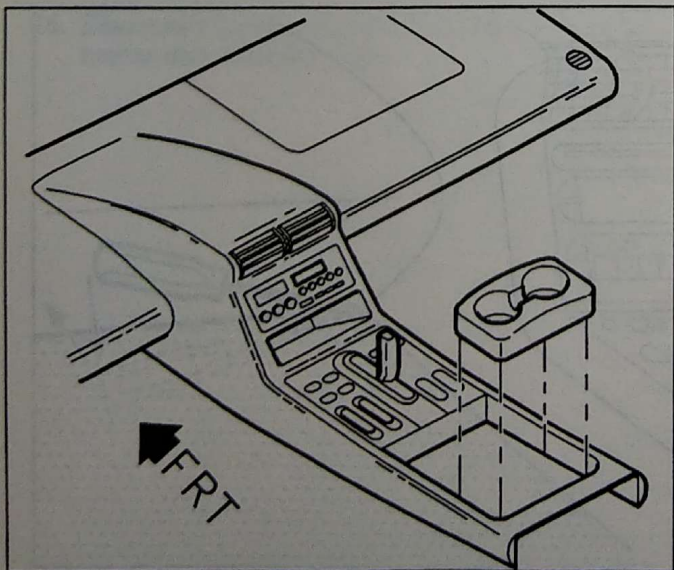
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PSMELC65847AA

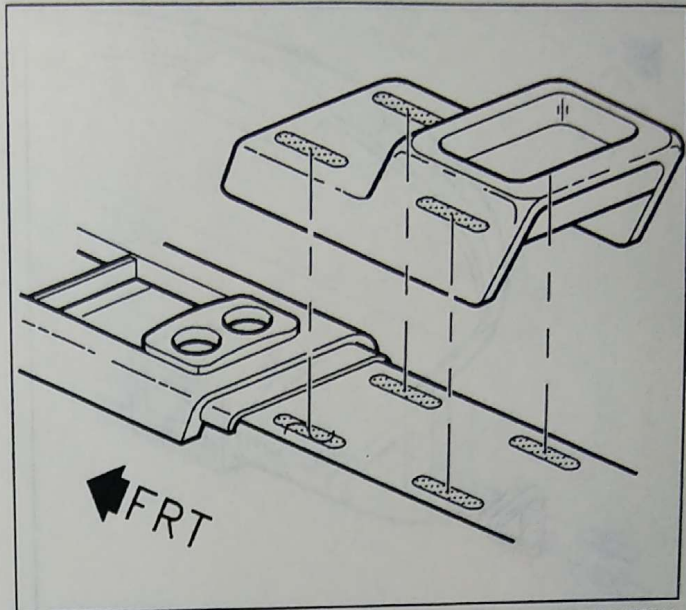


PSMMS65734AA

21. Push downward then forward on the screwdriver handle, lifting the lock tab upward and the radio rearward simultaneously. The radio should move rearward enough so that it can be pulled out the rest of the way by hand.
22. With the brake applied, shift run/lock shift assembly (RSA) to DRIVE, then select ACCY mode to shut Off power and apply the parking brake to keep the vehicle from rolling unexpectedly.
23. Lay a clean shop rag over the RSA to help protect it from getting scratched by the radio case during radio removal.
24. Slide radio out of instrument panel.
25. Disconnect the antenna lead first, then the harness connector.
26. With the brake applied, select the RUN mode again, and shift back to PARK. Then select the lock mode to turn the vehicle Off.

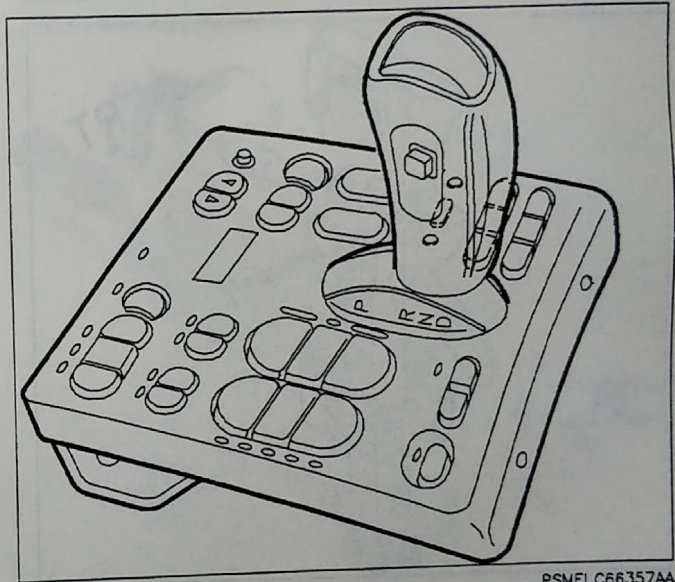
27. Remove cup holder.

28. Remove arm rest from tunnel by lifting upward releasing Dual-Lock retainers.



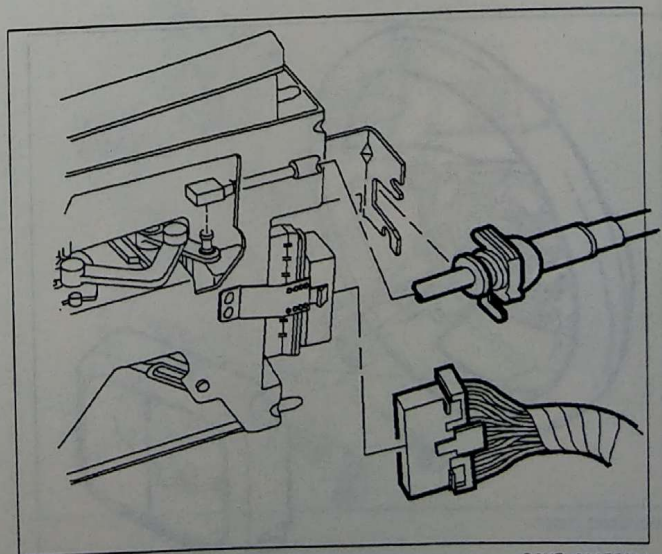
PSMMS65735AA

29. Remove the T-25 TORX™ screws in the rear of the RSA, pull RSA rearward about 63 mm (2.5 in.).

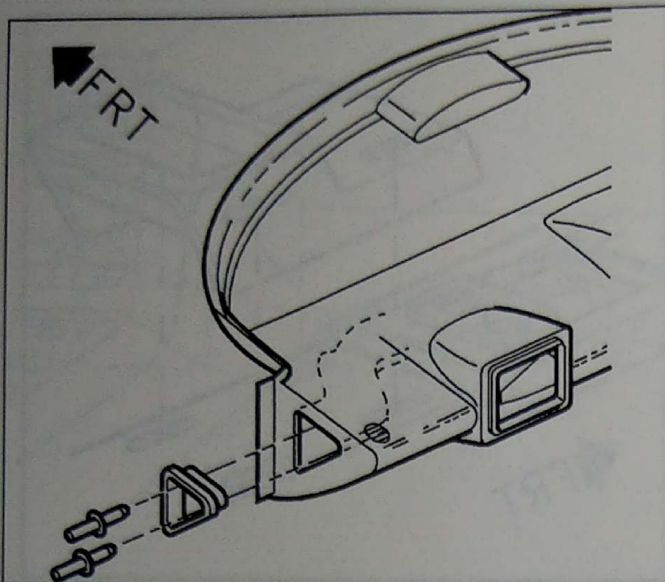


PSMELC66357AA

30. Rotate RSA towards the drivers side of the vehicle to a 45 degree angle.
31. Disconnect the RSA wire harness connector.
32. Disconnect the shift cable from the shifter and remove shift cable from retainer bracket by prying locking tab on drivers side of RSA gently and pushing cable down out of bracket.

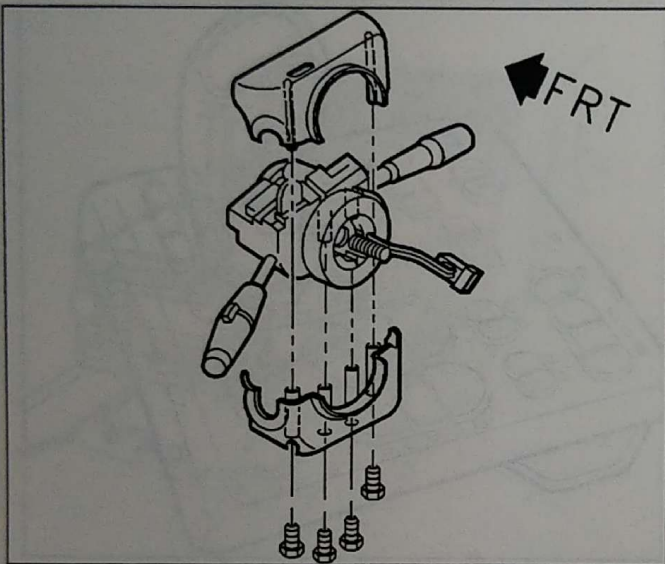


PSMELC66358AA



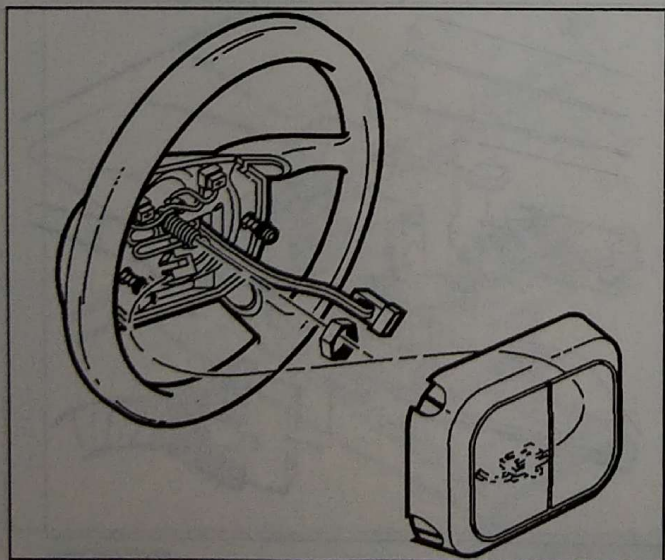
PSMVIS65736AA

33. Drill out rivets from side door air outlets.
34. Remove left and right front side door air outlets on the side of instrument panel with doors open.



PSMVIS65827AA

35. Remove outer screws from lower steering column trim cover, lift upper trim panel off.
36. Remove inner screws from lower steering column trim cover and remove lower trim cover.

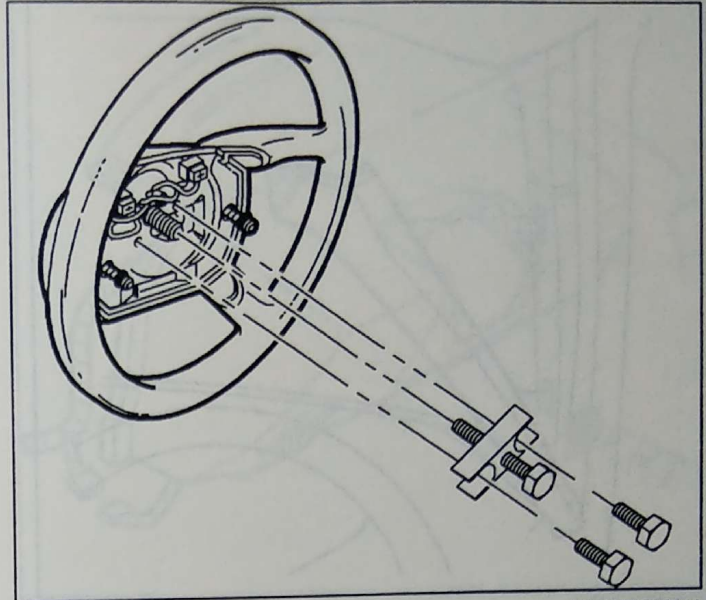


PSMVIS65863AA

37. Remove screws from back of steering wheel that retains SIR inflator module.
38. Remove connector position assurance (CPA) and disconnect inflator module connector.
39. Remove SIR inflator module.

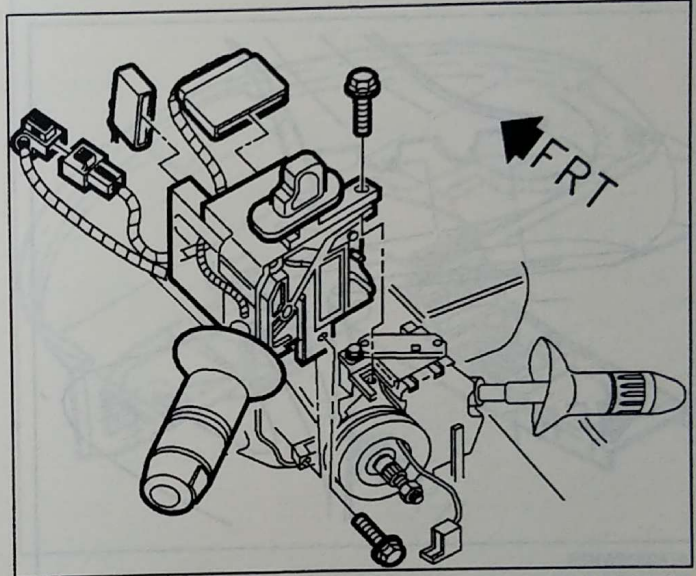


40. Disconnect horn switch connector.
41. Remove nut from steering column that retains steering wheel.
42. Install steering wheel puller SA9218NE and remove steering wheel.



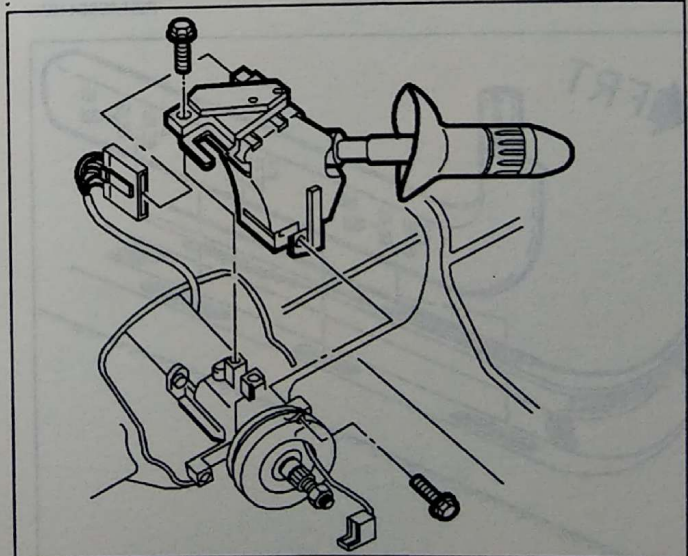
PSMVS65862AA

43. Remove T-25 TORX™ /7mm screws from turn signal, headlamp, and cruise switch.
44. Remove switch and disconnect switch connectors.



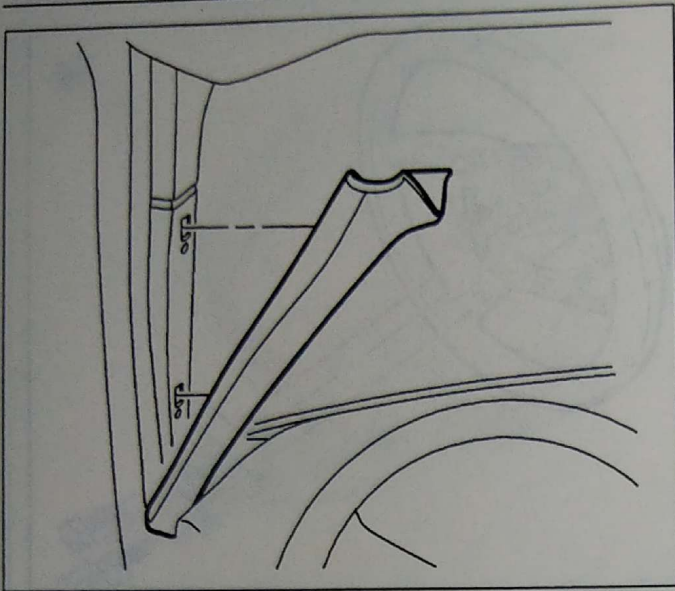
PSMELC66355AA

45. Remove T-25 TORX™ /7mm screws from windshield washer switch.
46. Disconnect connector and remove switch.



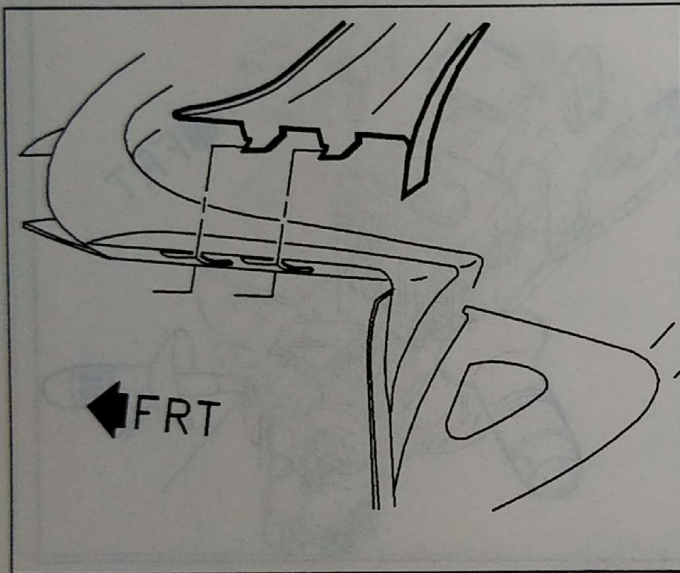
PSMELC66356AA

47. Starting at top of garnish molding, pull firmly at clip locations to disengage. Tipping the top of molding inward with the bottom engaged to instrument.



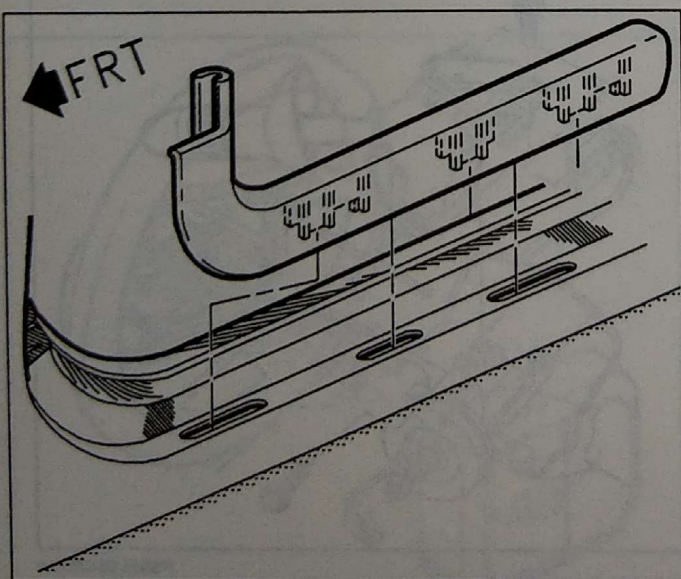
PSMVS66447AB

48. Disengage tabs on garnish molding from instrument panel by pulling rearward and inboard.



PSMVS66448AA

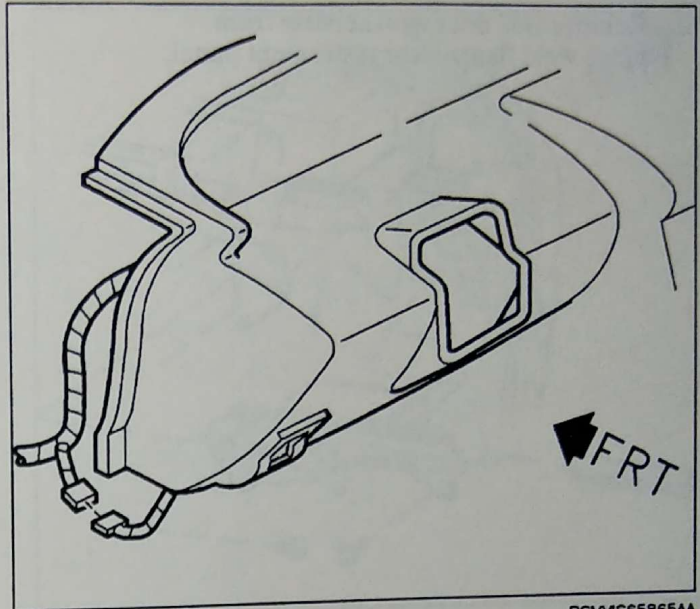
49. Starting at rear of carpet retainer, pull firmly on carpet retainer at clip locations to disengage clips.
50. Remove front side door opening floor carpet retainer.



PSMVS65733AA

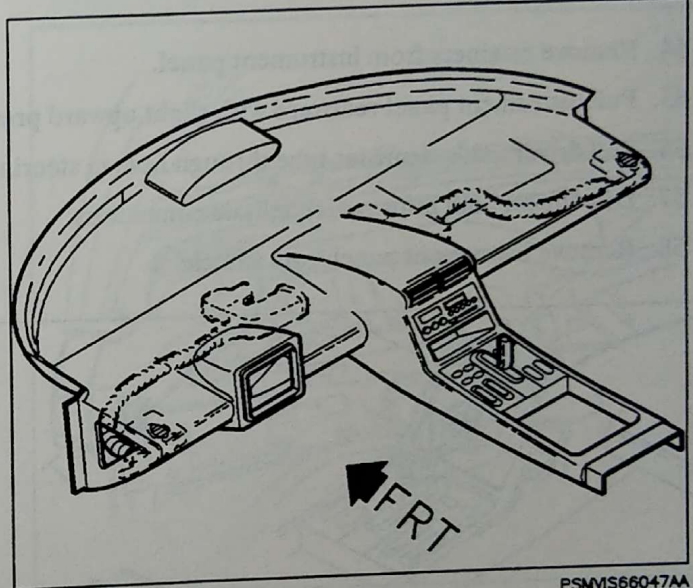


51. Disconnect parking brake switch connector.



PSMVS65865AA

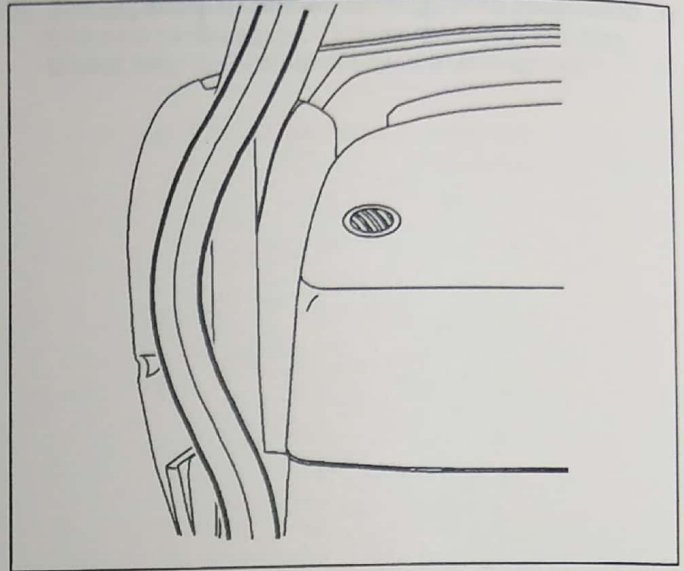
52. Disconnect side window demistor tubes from floor outlets.



PSMVS66047AA

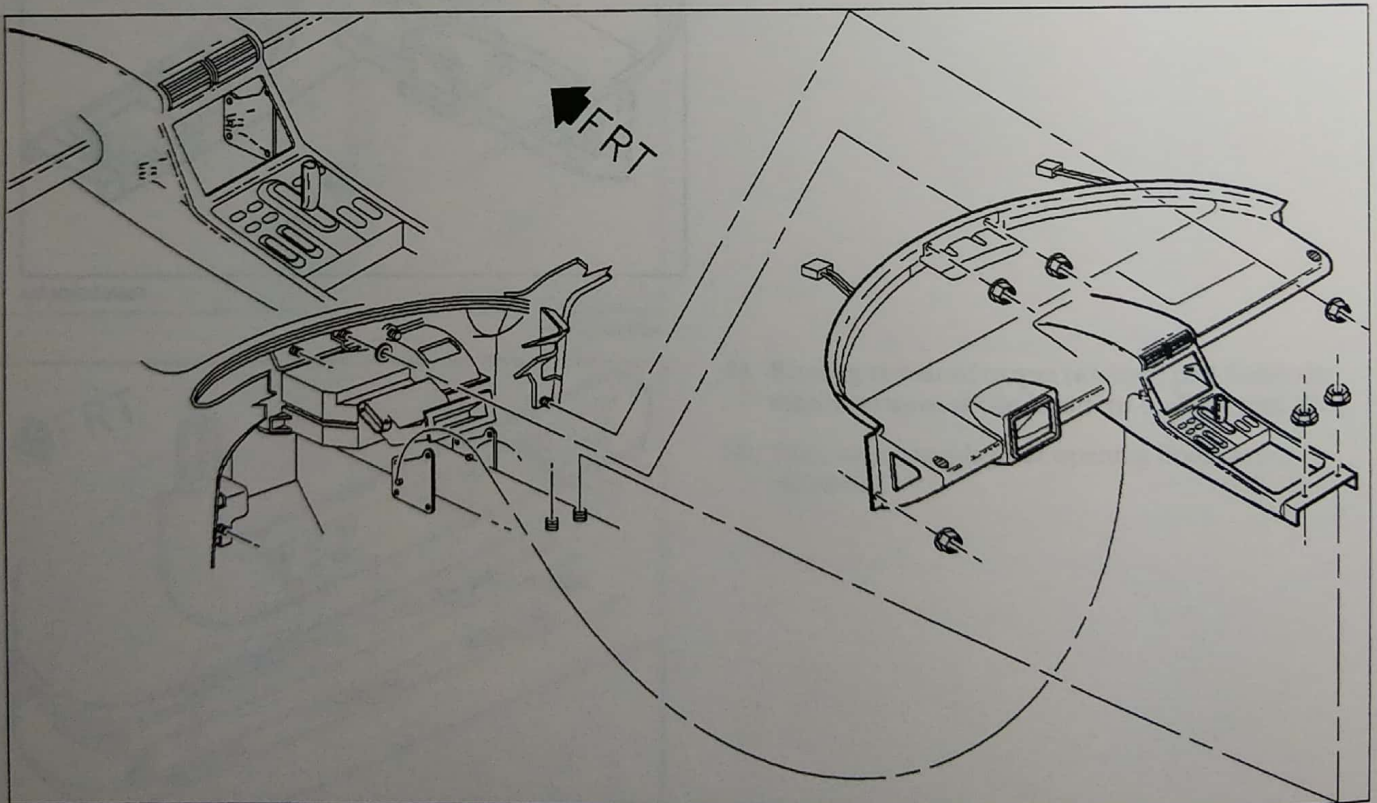
Heating, Ventilating, Air Conditioning and Controls

53. Remove side door weatherstrip from pinch weld flange near instrument panel.

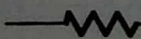


PSMVIS66337AA

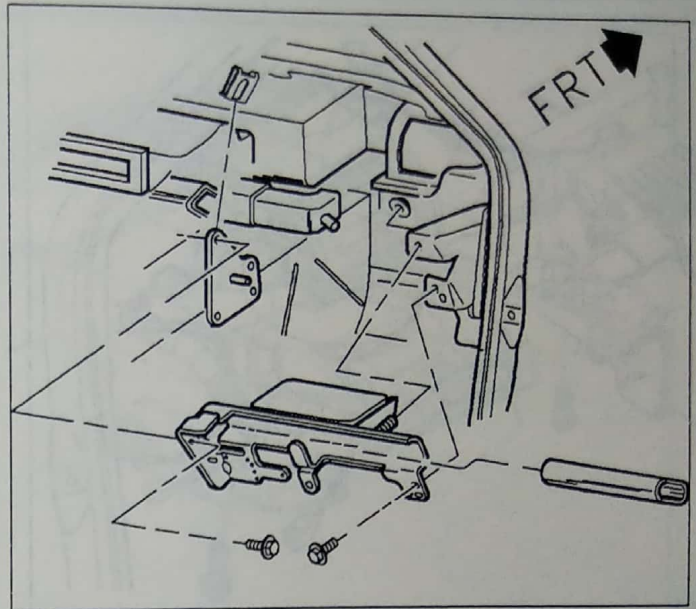
54. Remove retainers from instrument panel.
55. Pull instrument panel rearward with slight upward pressure.
56. Pull driver's side demister tube through hole in steering column support
57. Disconnect both information telltale connectors.
58. Remove instrument panel from vehicle.



PSMVIS66048AA

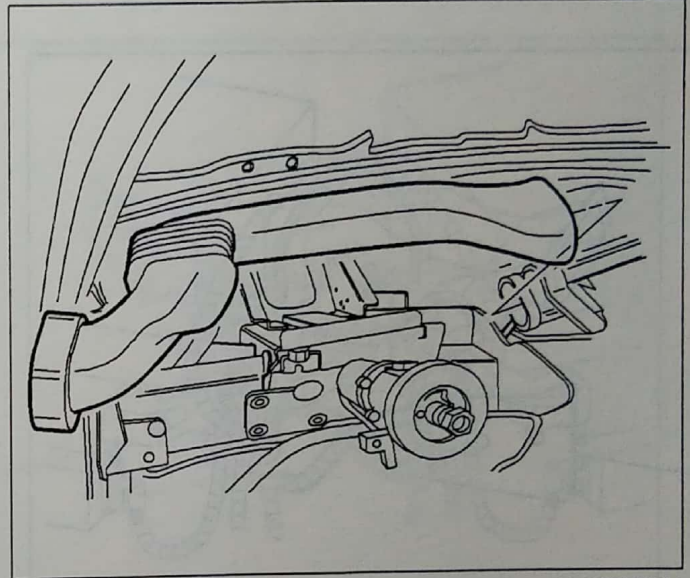


59. Remove passenger side HVAC cross car duct.
60. Disconnect cross car wiring harness rose buds from instrument panel knee bolster reinforcement.
61. Remove bolts and nuts from instrument panel knee bolster reinforcement.
62. Remove instrument panel knee bolster reinforcement from vehicle.



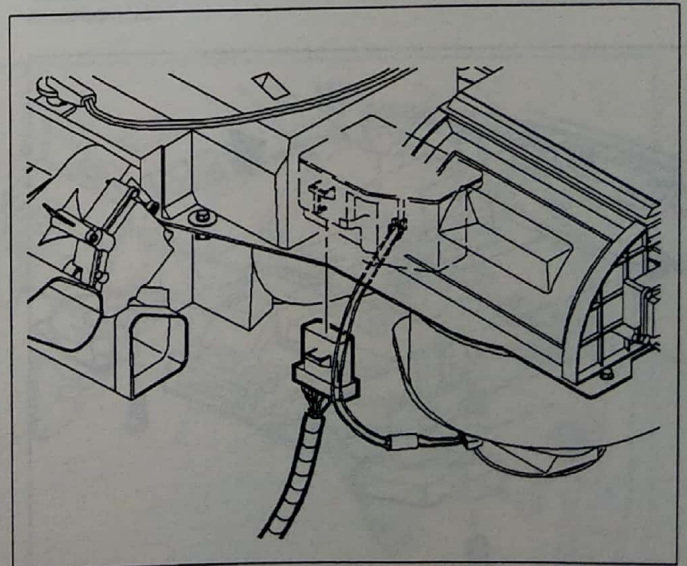
PSMVIS65818AA

63. Remove drivers side outer air duct.



PSMVIS66336AA

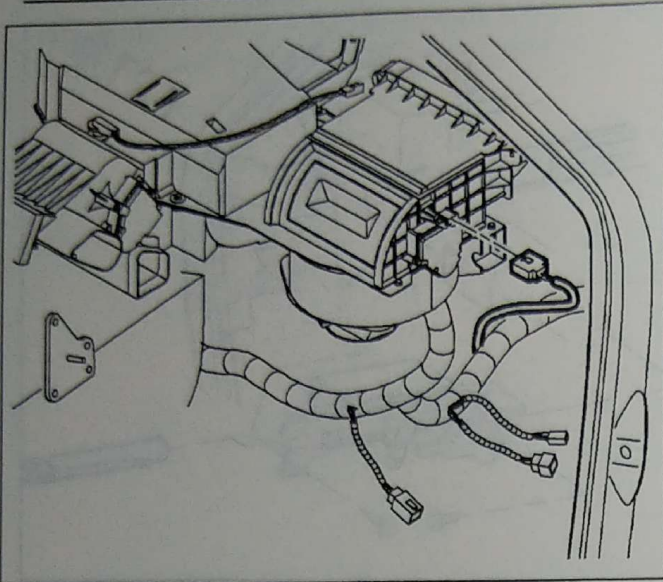
64. Disconnect blower motor pulse width modulation control module connector.



PSMHVC67531AA

65. Disconnect outside air valve actuator connector.

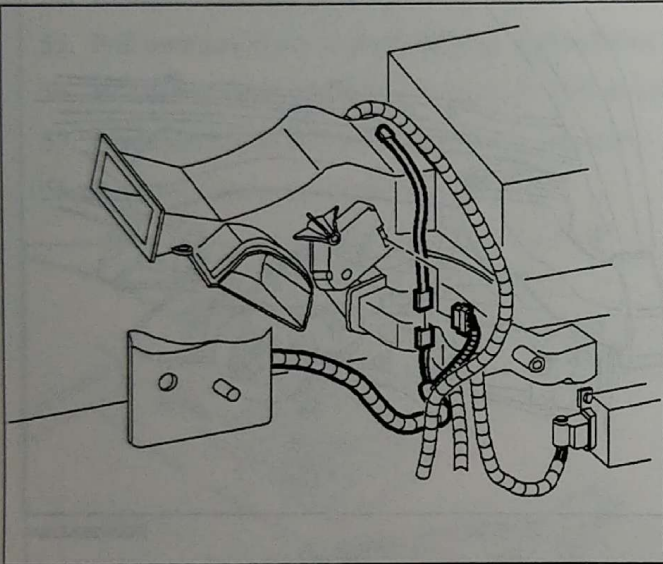
66. Remove wire harness rose bud retainers from heating and A/C module.



PSMHVC67532AA

67. Disconnect mode valve actuator connector.

68. Disconnect air temperature sensor connector.



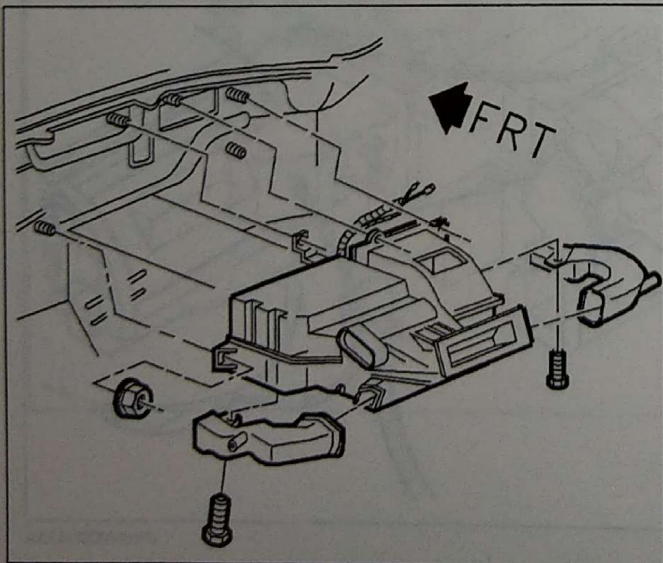
PSMHVC67533AA

69. Remove floor duct screws from heating and A/C module.

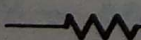
70. Remove floor duct from heating and A/C module.

71. Remove nuts retaining heating and A/C module at front of dash.

72. Remove heating and A/C module from vehicle while holding wire harness off of module when removing.



PSMHVC66801AA

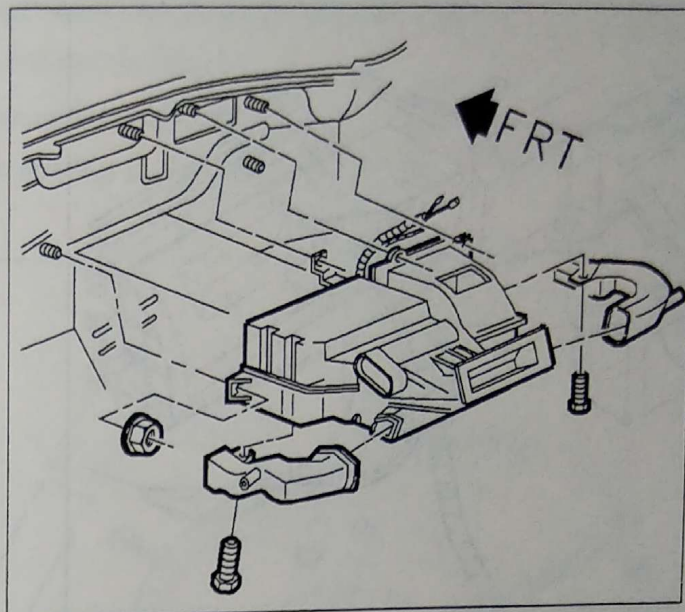


INSTALLATION

1. Position heating and A/C module into vehicle over the battery tunnel near front of dash.
2. Route cross car wire harness over the top of the module.
3. Install module onto studs on front of dash and tighten.

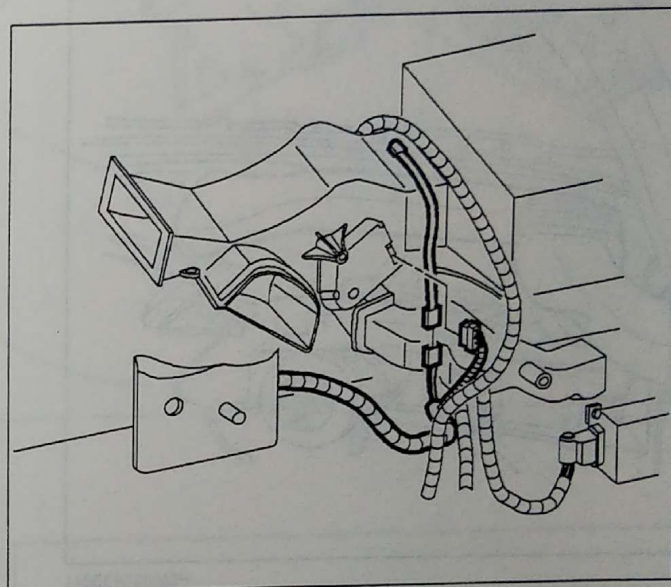
Torque: 4 N•m (36 in-lbs)

4. Install floor ducts onto heating and A/C module.



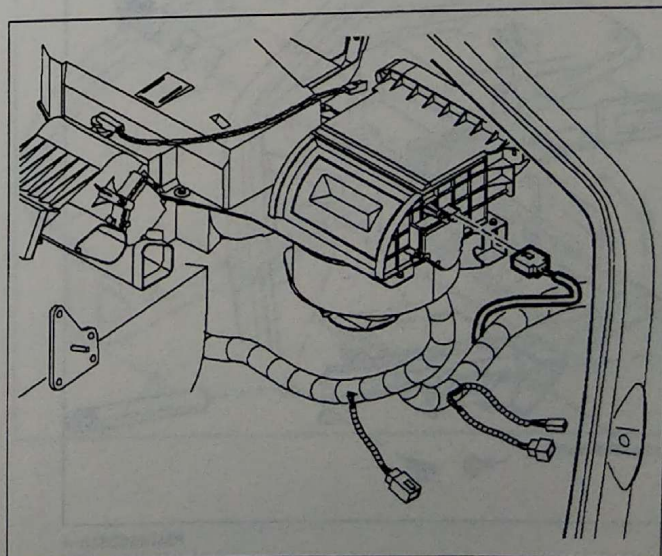
PSMHVC66801AA

5. Install floor duct screws into heating and A/C module. Hand tighten.
6. Connect mode valve actuator connector.
7. Connect air temperature sensor connector.

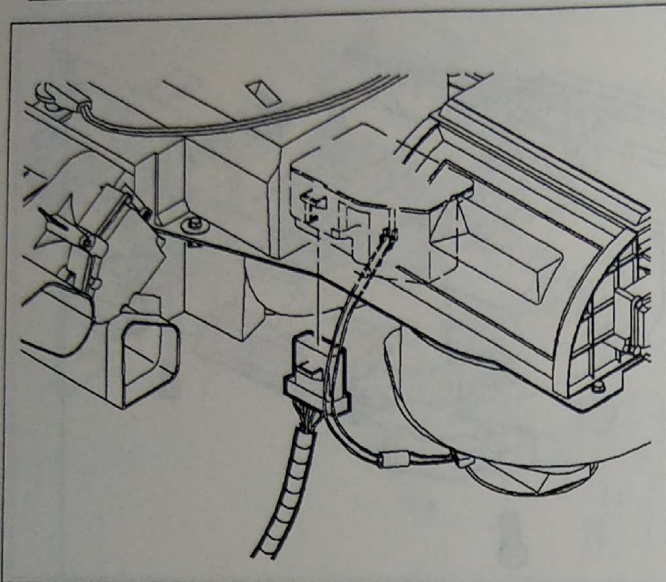


PSMHVC67533AA

8. Connect outside air valve actuator connector.
9. Install wire harness rose bud retainers to heating and A/C module.

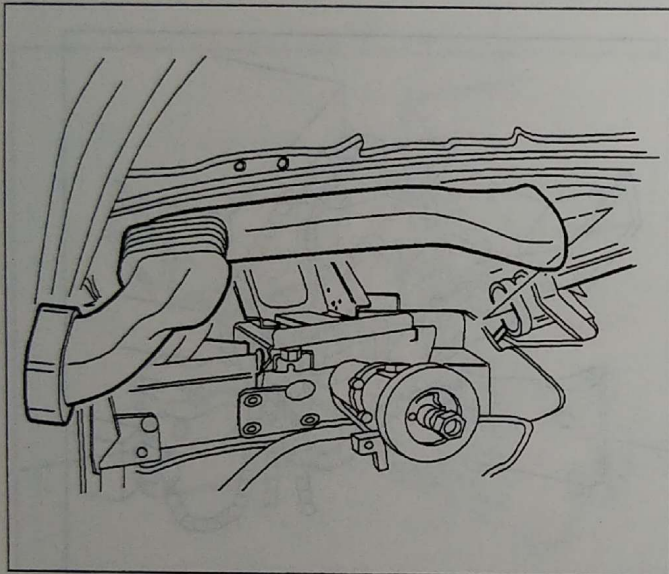


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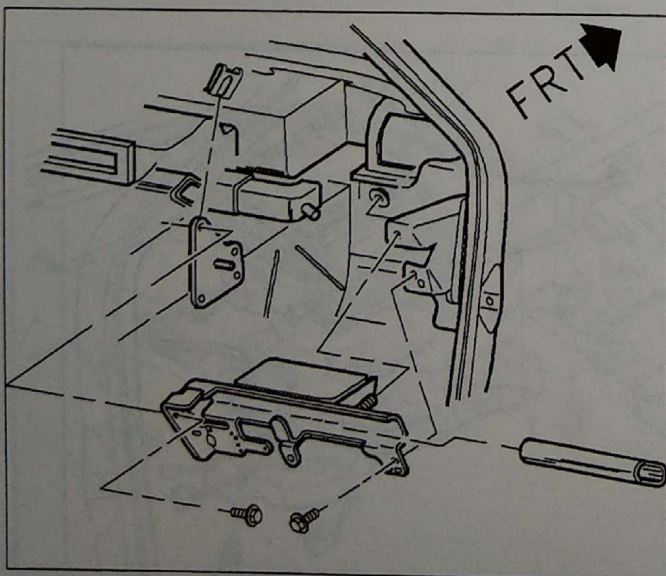
PSMHVC67531AA

10. Connect blower motor pulse width modulation control module connector.



PSMVIS66336AA

11. Install driver's side outer air duct.

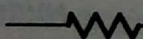


PSMVIS6581BAA

12. Install instrument panel bolster reinforcement to space frame. Install bolts and nut. Torque in sequence.

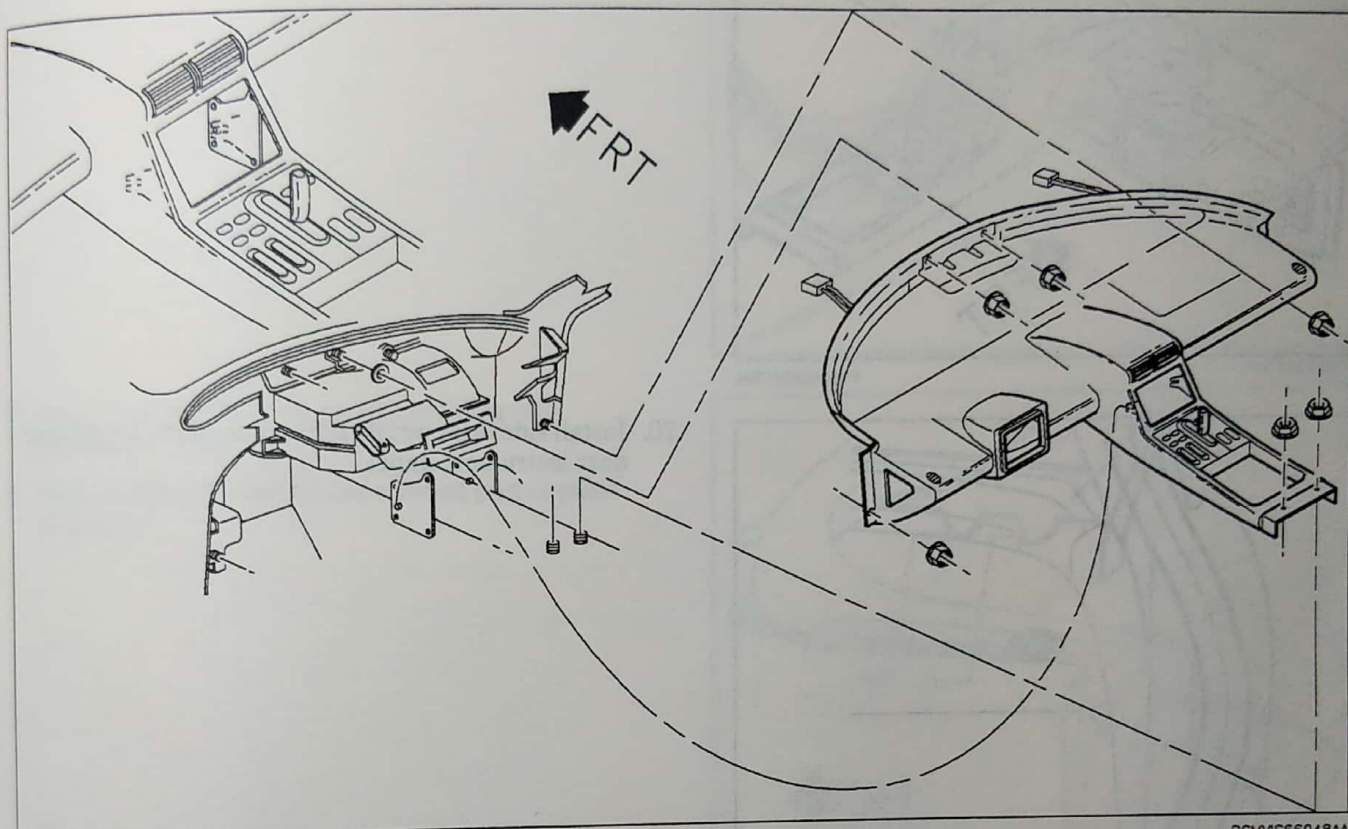
Torque: 33 N•m (24 ft-lb)

13. Install passenger side cross car duct into bolster reinforcement and seat into heating and A/C module.
14. Insert cross car wire harness rose buds into instrument panel knee bolster reinforcement.



IMPORTANT: Before assembling make sure spacer is in proper location to body. Refer to illustration.

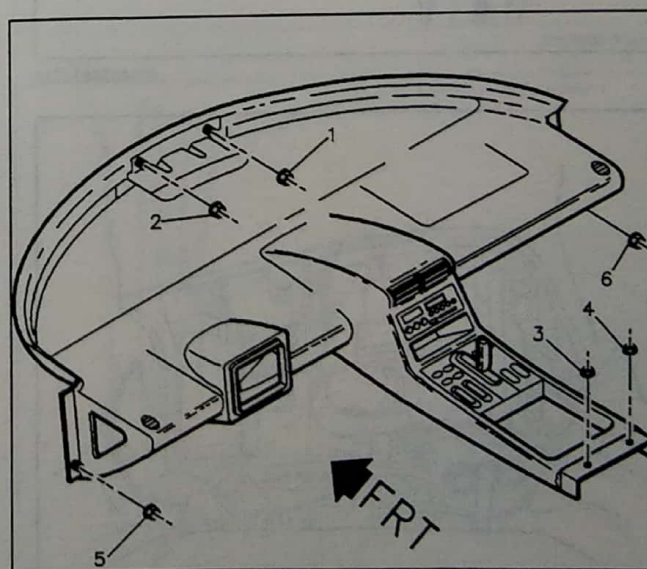
15. Set instrument panel in location and connect information telltale connectors.
16. Guide driver's side demister tube into and through hole in steering column support.
17. Install instrument panel over studs on front of dash. The tunnel has locator pins on either side of which the instrument panel has to be located on when installing.



PSMVIS66048AA

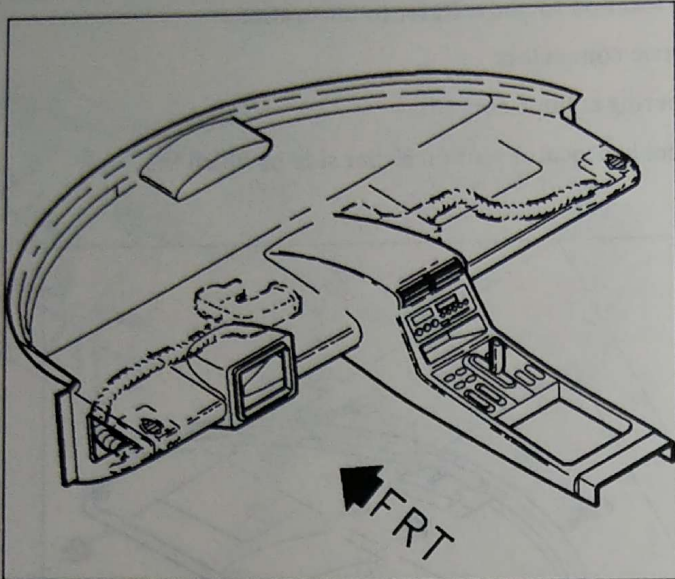
18. Secure instrument panel fasteners.
Torque in sequence shown.

Torque: 5 N•m (44 in-lbs)



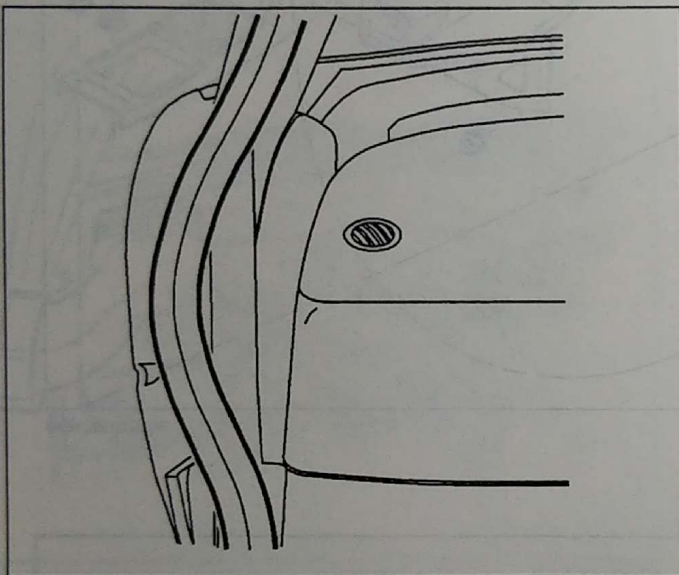
PSMVIS66049AA

19. Connect side window demister tubes to floor outlets.



PSMVIS66047AA

20. Install side door weatherstrip onto pinch weld flange near instrument panel.



PSMVIS66337AA

21. Connect connector to windshield washer switch.

22. Install screws retaining switch.

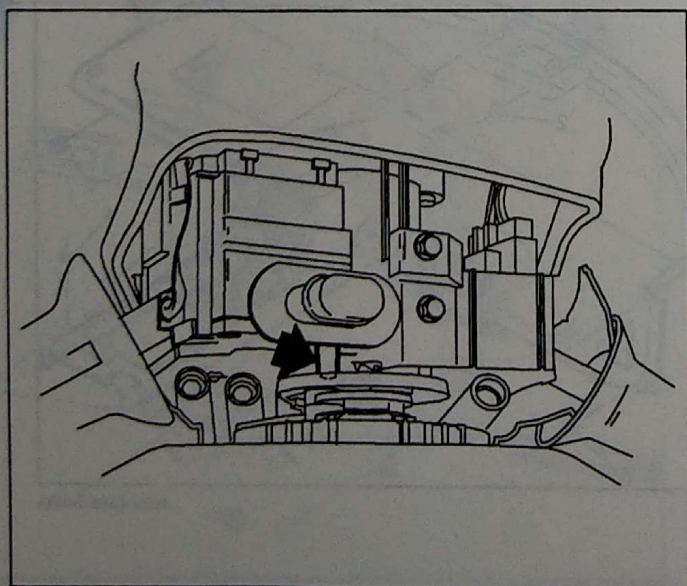
Torque: 2.5 N•m (22 in-lbs)

23. Connect connectors to turn signal, headlamp, and cruise switch.

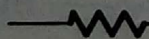
24. Place switch in position, being careful that the pin is positioned correctly against the ring on the back of the turn signal cancel cam assembly.

25. Install screws retaining switch.

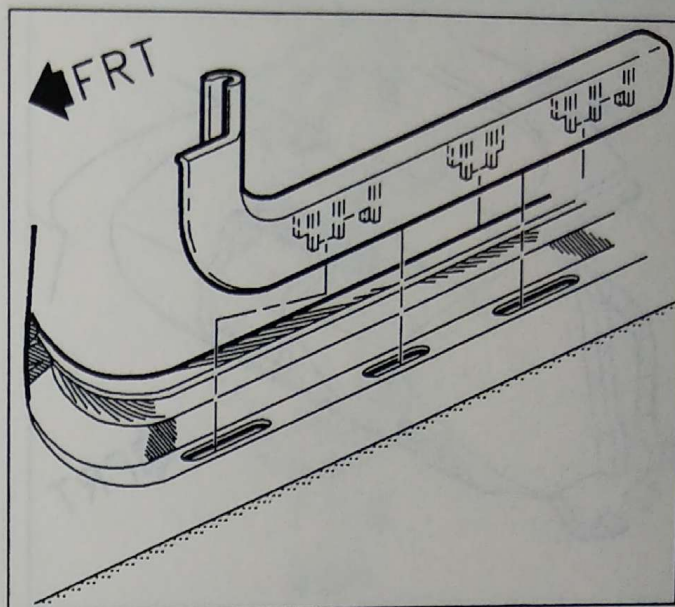
Torque: 2.5 N•m (22 in-lbs)



PSMELC66439AA

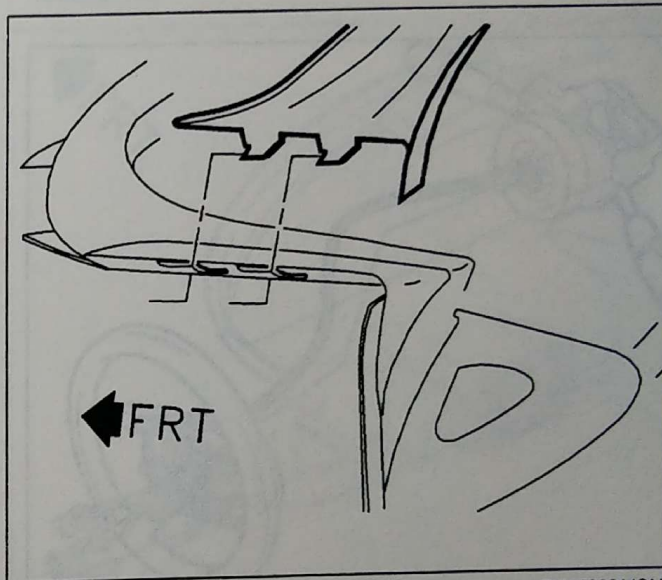


26. Locate carpet retainer to door opening.
27. Firmly seat carpet retainer into weather.
28. Snap clips into slots in inner rocker pan.



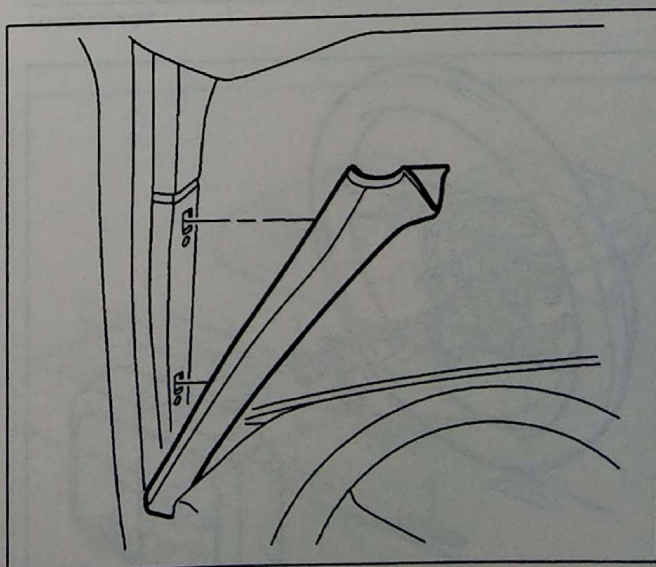
PSMVS65733AA

29. Insert tabs on bottom of garnish molding into instrument panel.
30. Push molding downward and forward past A-pillar structure.



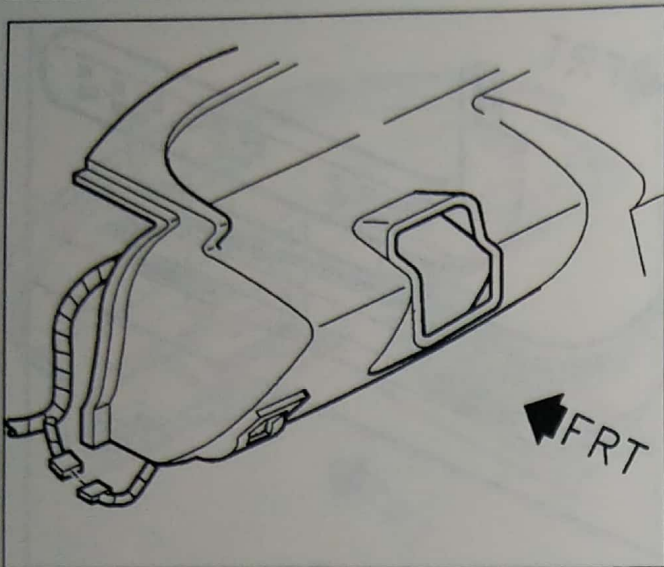
PSMVS66448AA

31. Push molding to structure pressing forward and outward to insure proper fit to instrument panel, headlining and door seal.
32. Align clips on garnish molding to slots in A-pillar and press firmly at clip locations.
33. Position flap on door weatherstrip over windshield garnish molding.



PSMVS66447AB

34. Connect park brake switch connector.



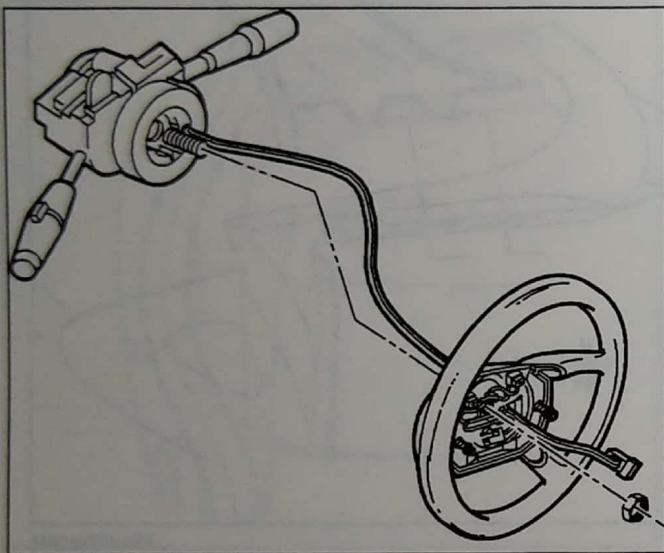
PSMVIS65865AA

35. Route SIR cable through steering wheel. Install steering wheel to column.

36. Connect horn wire connector.

37. Install steering wheel nut.

Torque: 42 N•m (31 ft–lbs)



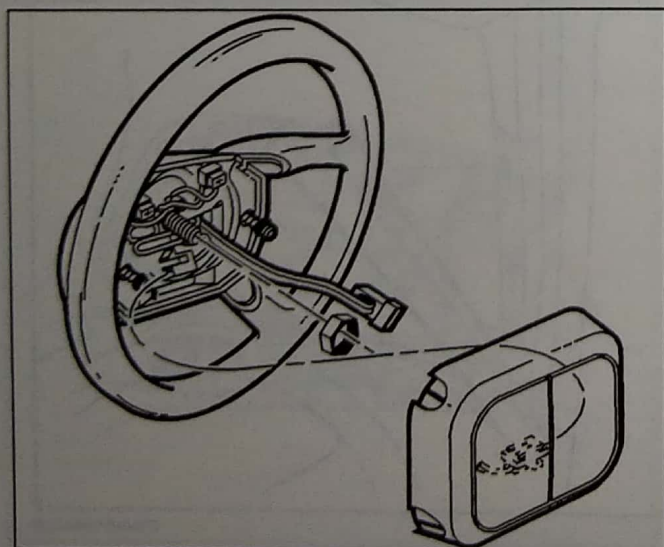
PSMVIS65864AA

38. Route yellow SIR inflator module wire harness within the steering wheel hub forming an “S” shape with wire and connect SIR inflator module connector.

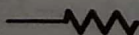
39. Install CPA, to connector.

40. Install inflator module to steering wheel.

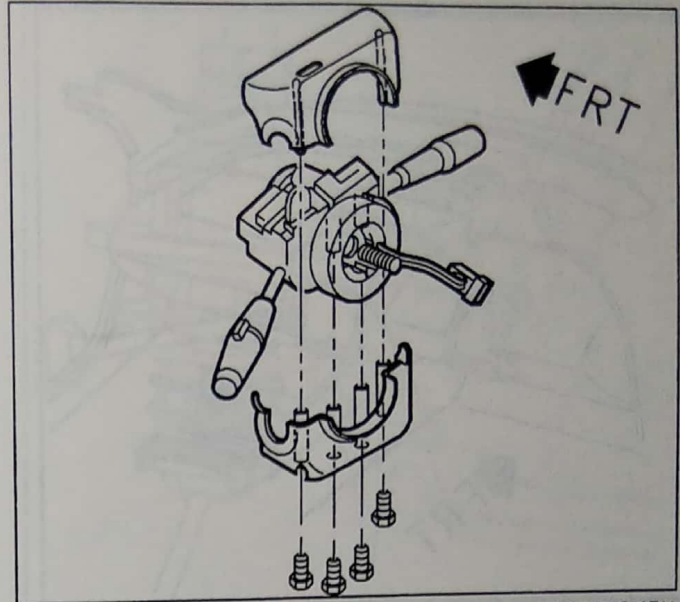
Torque: 10 N•m (89 in–lbs)



PSMVIS65863AA

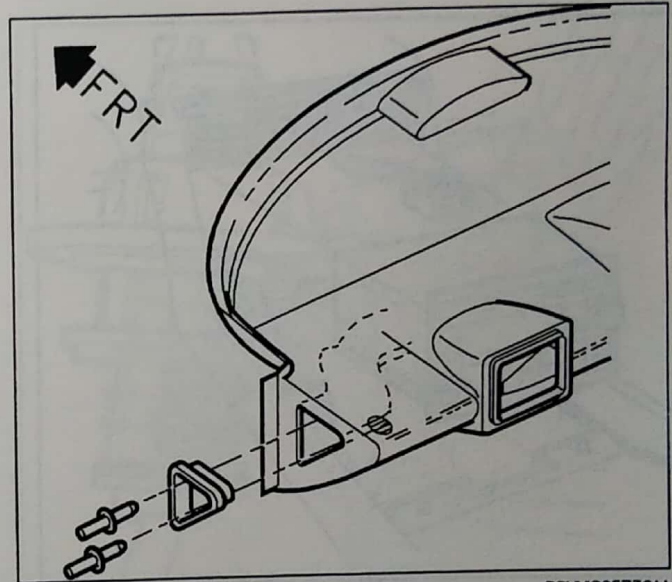


41. Align lower steering column trim cover to steering column. Install and tighten inner screws.
42. Align upper steering column trim panel to steering column and install outer screws in lower steering column trim panel. Tighten outer screws.



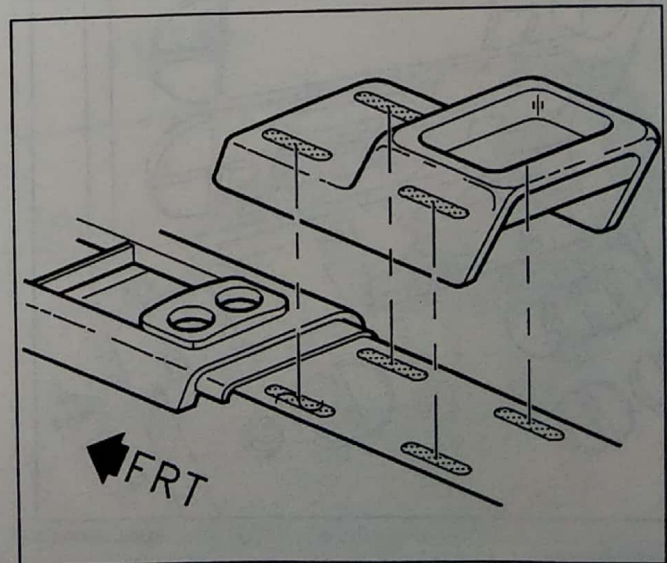
PSMMS65827AA

43. Install left and right front side door air outlets on side of the instrument panel using new fasteners.

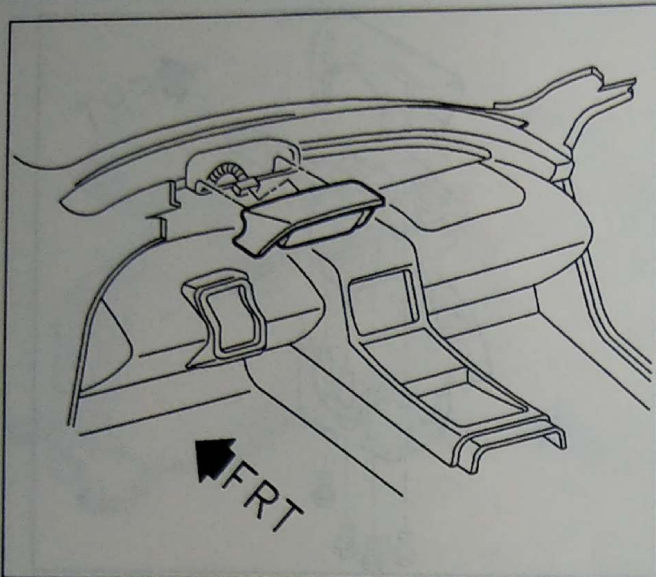


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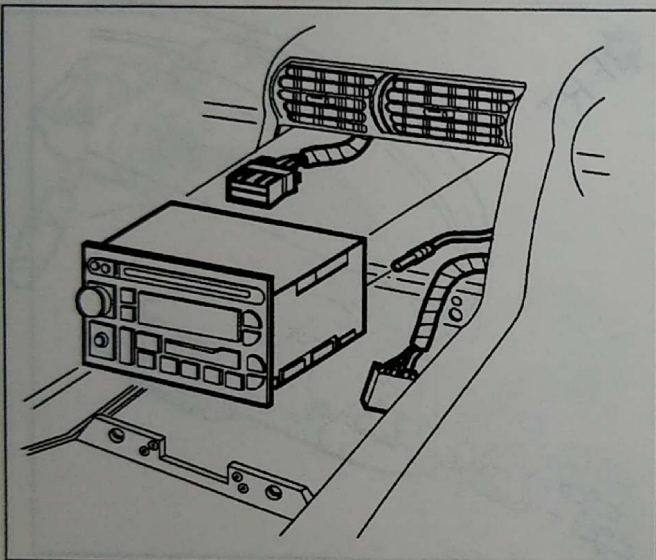
44. Install arm rest



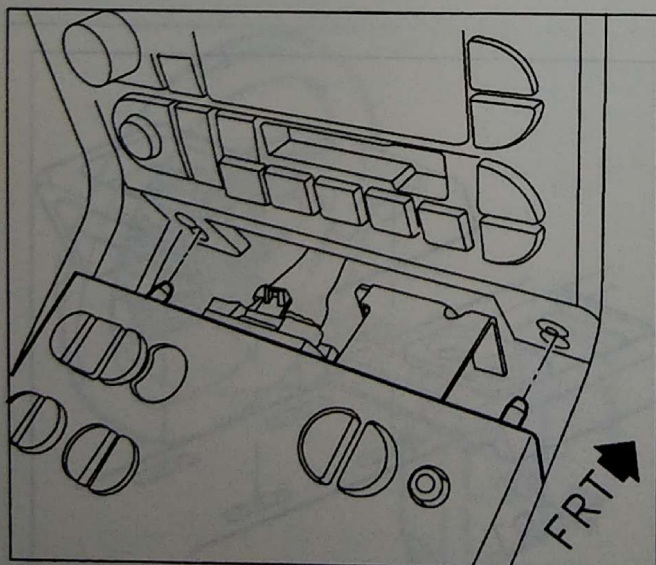
PSMMS65735AA



PSMELC66359AA



PSMELC65847AA



PSMELC66360AA

45. Push harness connector into socket on instrument panel cluster. Verify connection is made, seated and locked.
46. Install instrument panel cluster into instrument panel by pushing forward and downward.

47. Connect radio harness to radio, then antenna lead to radio. Verify both connections are seated properly.
48. Make sure antenna and harness are up and out of the way of the radio bracket. Slide radio into opening until the radio is seated and the radio fits tightly to the console. You may hear a click as the radio tab locks into the bracket.

49. Cover the radio face with a rag for protection during RSA installation. Install shift cable housing into shift bracket and connect and secure shift cable to shifter. Be sure clip lock tab is in place.

50. Connect wire harness connector to RSA.

51. Align RSA locator tabs to front of instrument panel and push down on the rear of the RSA.

52. Install TORX™ fasteners.

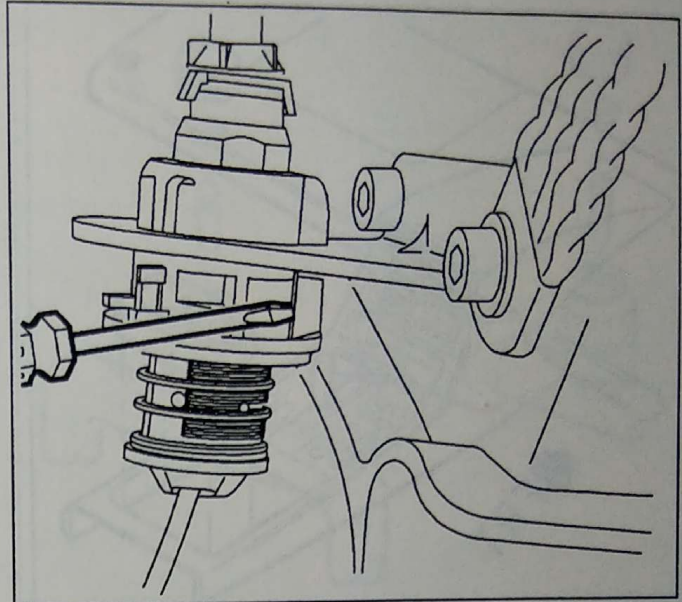
Torque: 6 N•m (53 in-lbs)

IMPORTANT: You must adjust shift cable at final drive unit.

53. Adjust shift cable:

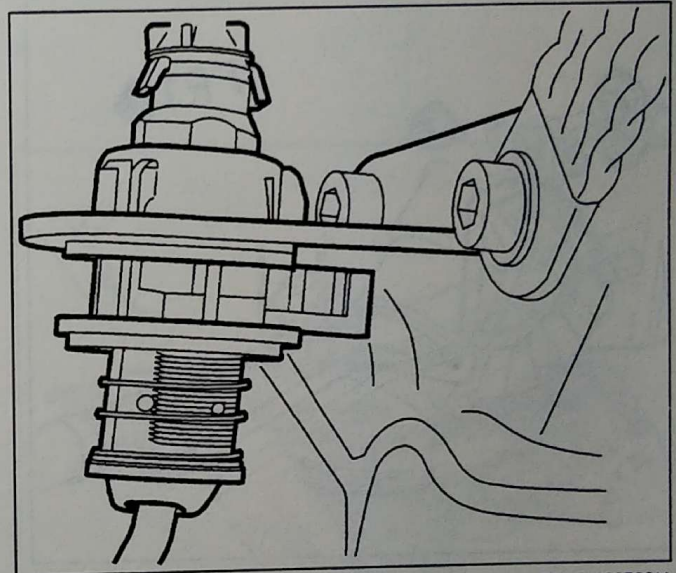
IMPORTANT: The shift cable must be attached to the RSA with the RSA secured in position. Shift handle must be placed in neutral before cable adjustment is performed.

- a. Remove underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" in this manual.)
- b. Unlock U-shaped adjustment collar. Collar is located aft of drive unit bracket, and will unlock by inserting a pocket screwdriver into gap and prying towards drive unit.



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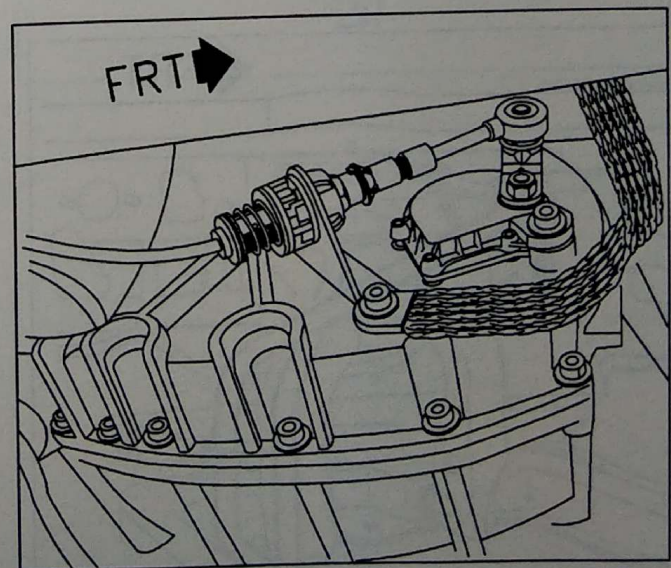
IMPORTANT: About 13 mm (1/2 in.) movement necessary to insure unlock position.



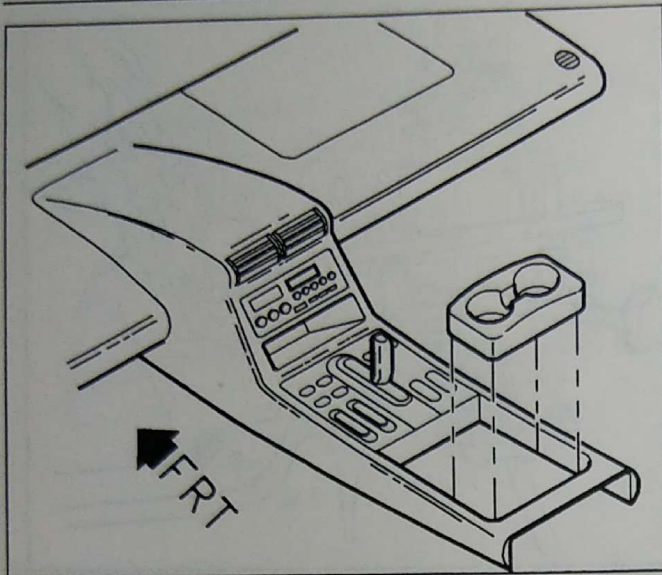
PSMELC66366AA

- c. Verify shift lever is in neutral. Push U-shaped collar into lock position. Collar will move to right side of vehicle.
- d. By hand shift park/lock lever to the full counterclockwise position (DRIVE) then move one detent in the clockwise direction (NEUTRAL).
- e. Install underbody front air deflector assembly. (Refer to "Underbody Front Air Deflector Assembly" in this manual.)

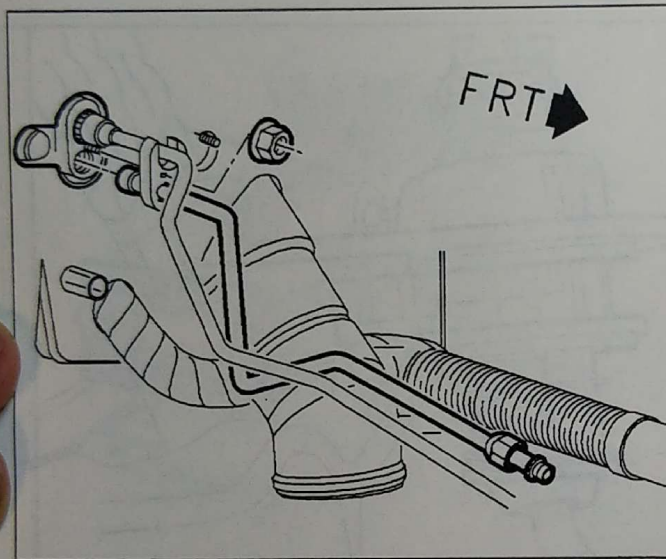
NOTICE: If shift cable has been removed more than six times at either end, for any reason, the cable must be replaced.



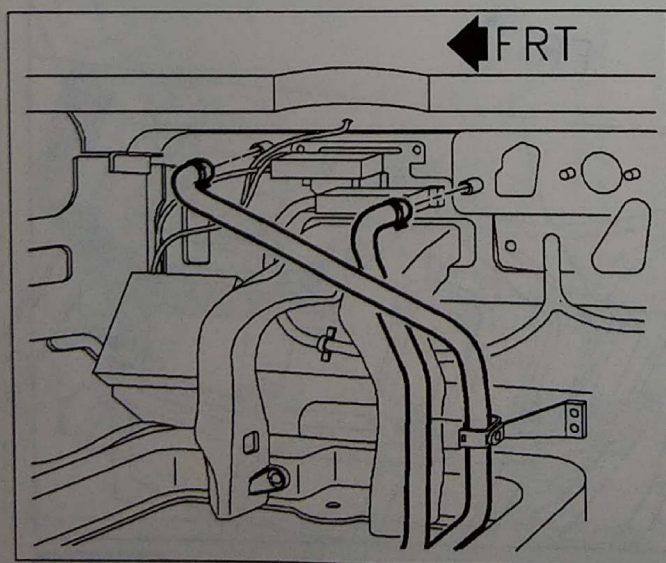
PSMELC66364AA



PSMVS65734AA



PSMHVC66802AA



PSMHVC67534AA

54. Install cup holder to center console.

55. Enable the SIR system. (Refer to "Enabling the SIR System" in this manual.)

56. Remove O-ring from evaporator tube and condenser tube, install a new Electric Vehicle approved service replacement O-ring.

NOTICE: Use on R-12 Refrigerant oil (mineral) to lubricate O-rings. Use of R-134a (PAG) oil or R-134a heat pump (ester) oil will cause premature corrosion of fitting joints.

57. Lubricate O-ring with R-12 mineral refrigerant oil.

58. Connect condenser tube to evaporator.

59. Connect evaporator tube to evaporator.

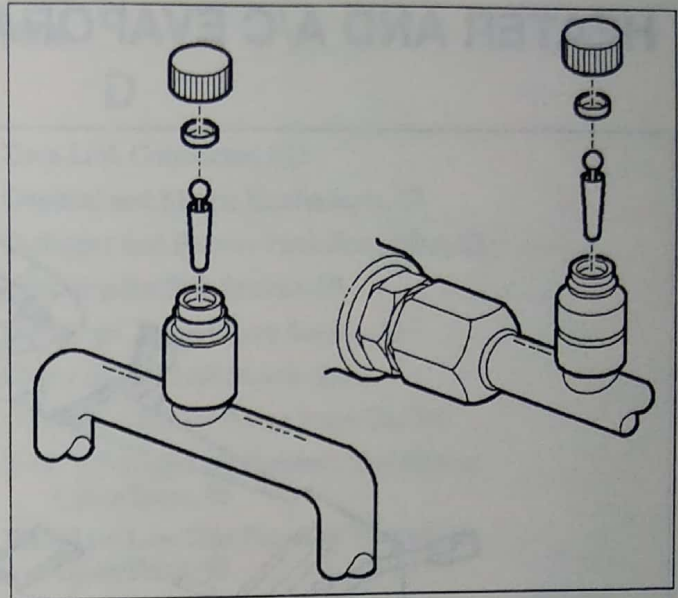
60. Install evaporator tube nut and tighten.

Torque: 16 N•m (12 ft-lb)

61. Install heater inlet hose and clamp to heater core inlet. Position clamp tangs at 12 o'clock.

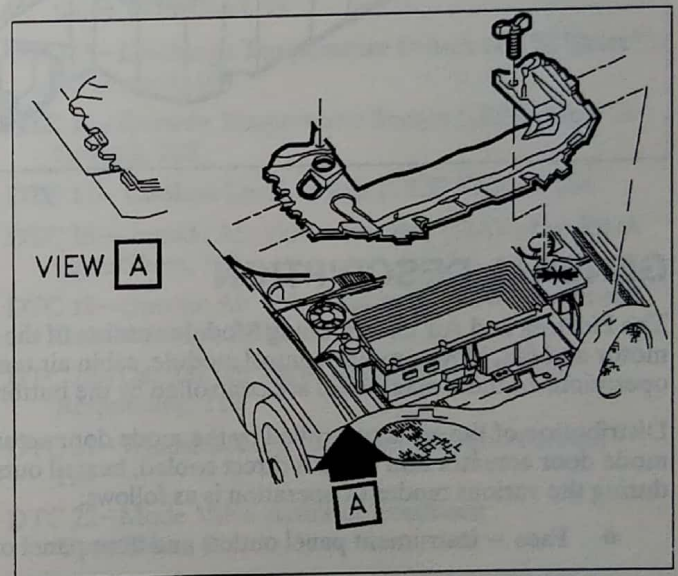
62. Install heater outlet hose and clamp to heater core inlet. Position clamp tangs at three o'clock.

63. Install new Electric Vehicle approved service replacement heat pump schrader valves.
64. Evacuate, charge, and leak test heat pump system.
65. Fill coolant system. (Refer to "Coolant Fill Procedure" in this service manual).
66. Verify heat pump operation by performing system performance test.



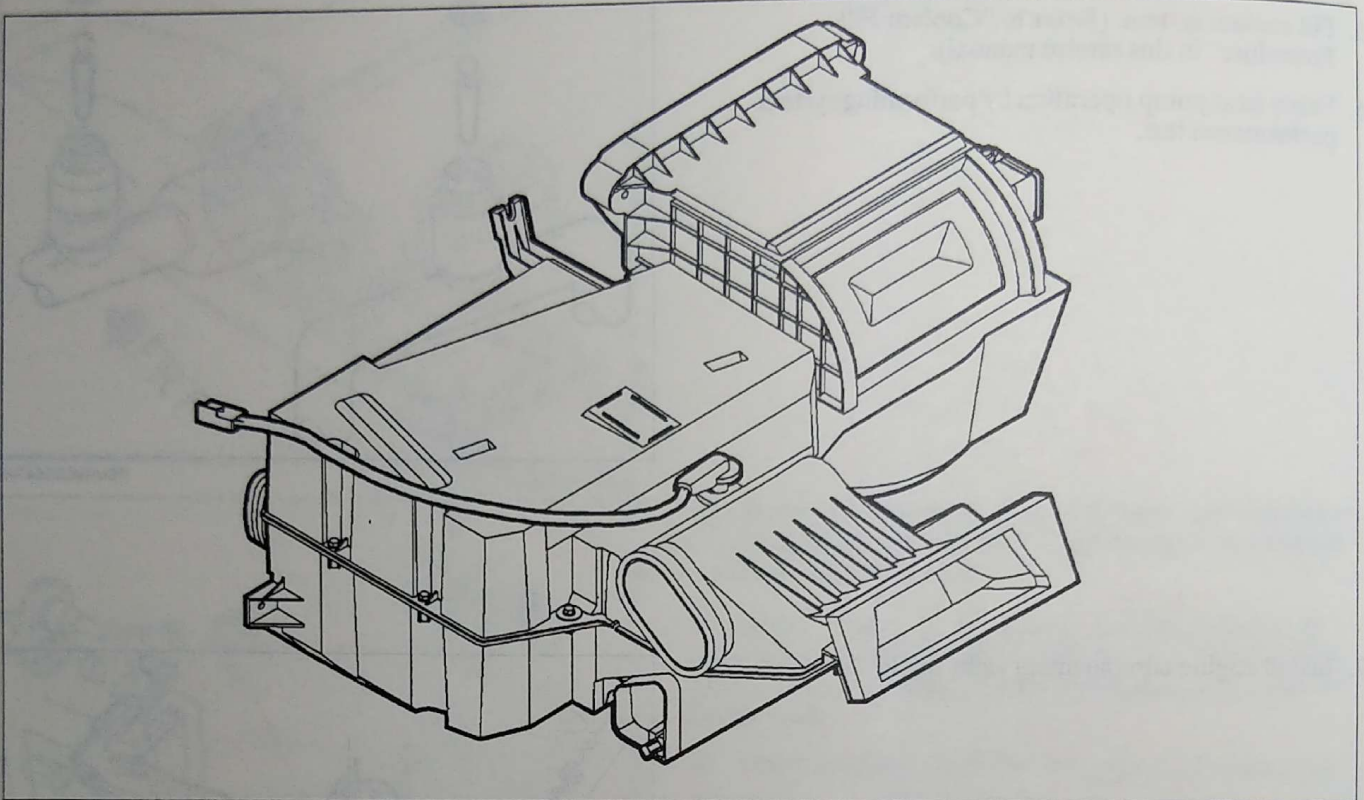
PSMHVC66647AB

67. Install engine compartment sight shield.



PSMGEP65869AC

HEATER AND A/C EVAPORATOR AND BLOWER MODULE



PSMHVC67396AA

GENERAL DESCRIPTION

The Heating and Air Conditioning Module consists of the outside air valve actuator, mode door actuator, blower motor and fan, blower motor control module, cabin air temperature sensor, heater core and evaporator core. The operations of these assemblies are controlled by the buttons on the run/lock shifter assembly (RSA).

Distribution of the air is controlled by the mode door actuator and buttons on the RSA. The various position of the mode door actuator and buttons direct cooled, heated outside or inside air through the air ducts. The flow of air during the various modes of operation is as follows:

- Face – instrument panel outlets and door panel outlets
- Face and Feet – instrument panel outlets, door panel outlets, and floor outlets with a small amount of bleed air to the side window demisters.
- Feet – floor outlets with a small amount of bleed air to the side window demisters

Evaporator Core:

In the cooling mode the evaporator is a device which cools and dehumidifies the air before it enters the passenger compartment. Low pressure liquid refrigerant flows through the orifice tube into the evaporator. The heat in the air passing through the evaporator core is lost to the cooler surface of the core, thereby cooling the air. As the process of the heat loss from the air to the evaporator core surface is taking place, the moisture (humidity) in the air condenses on the outside surface of the evaporator core and is drained off as water.

In the heating mode warm coolant is circulated through the heater core and the evaporator would then become a condenser which warms the air before it enters the passenger compartment. High pressure refrigerant vapor is pumped from the reversing valve to the evaporator. The cold air passing through the evaporator core absorbs the heat from the evaporator core, thereby warming the air.

The heating and A/C module is service complete with actuators, blower motor, and blower motor control module. Internal module components are not serviced.

Index

A

- A/C Accumulator Assembly, 307
 - General Description, 310
 - Installation, 308
 - Removal, 307
- Accessory AC and DC Power Module, 207
- Accessory AC and DC Power Module (APM), 79
- Accessory Power Module (APM), 208
- Accumulator Bracket, 311
 - Installation, 311
 - Removal, 311
- APM Status Messages and Load Shed Command, 81
- APM Wakeup/Run, 82
- Auxiliary Battery Power, 79

B

- Battery Recovery Switch, 209
- Blower Motor, General Description, 313
- Blower Motor Assembly, 312
 - Installation, 312
 - Removal, 312
- Blower Motor Control Module Assembly, 318
 - General Description, 319
 - Installation, 318
 - Removal, 318
- Blower Motor Module, 209

C

- Charger Receptacle, 210
- Charger Receptacle Coolant Valve, 210
- Climate Control, 197
- Climate Controls Location Views, 76
- Compressor Control, 80
- Compressor Mounting Bracket, 289
 - Installation, 289
 - Removal, 289
- Condenser, Radiator, Fan Module Assembly (CRFM), 301
 - General Description, 301
- Condenser Radiator Fan Module Assembly (CRFM), 291
 - Installation, 296
 - Removal, 291
- Coolant Level Sensor, 211
- Coolant Recovery Check Valve, 212
- Cooling Fan, 196

D

- Data Link Connector, 213
- Decimal and Metric Equivalents, 27
- Defogger and Battery Pack Fan Inline, 214
- Disabling the SIR System, 19
- Discharge Temperature Sensor, 215
- Driver Door Jamb Switch, 215
- DTC 00—Coolant Pump Stays On, 84
- DTC 10—High Side Pressure Transducer Open/Short, 88
- DTC 11—Low Side Pressure Transducer Open/Short, 92
- DTC 12—Drive Motor Coolant Temperature Sensor (DMTS) Short To Ground, 94
- DTC 13—Refrigerant Temperature Sensor (RTS) Short To Ground, 96
- DTC 14—Pump Coolant Temperature Sensor (PCTS) Short To Ground, 98
- DTC 15—Discharge Temperature Sensor (DTS) Short To Ground, 100
- DTC 16—Outside Temperature Sensor (OTS) Short To Ground, 102
- DTC 17—Coolant Level Switch (CLS) Failure, 104
- DTC 18—Outside Air Valve Actuator (OAV) Feedback Open/Short, 108
- DTC 19—Outside Air Valve Actuator (OAV) Feedback Out Of Range, 110
- DTC 20—Outside Air Valve Actuator (OAV) Not Responding, 112
- DTC 21—Windshield On Command Output Failure, 114
- DTC 22—Mode Valve Actuator Feedback Open/Short, 116
- DTC 23—Mode Valve Actuator Feedback Out Of Range, 118
- DTC 24—Mode Valve Actuator Not Responding, 120
- DTC 25—Compressor Motor Case Voltage High, 122
- DTC 26—Preconditioning Aborted, 124
- DTC 27—Accessory Power Module (APM) Shutdown, 126
- DTC 28—Heated Windshield Fault, 128
- DTC 29—Compressor Motor Control (CMC) Isolated Gate Bi—Polar Transistor (IGBT) Fault #1, 130
- DTC 30—Compressor Motor Control (CMC) Overcurrent Fault #2, 132
- DTC 31—Compressor Motor Control (CMC) Input Voltage Out Of Range, 134
- DTC 32—Compressor Motor Control (CMC) Overtemp Or Interlock Fault, 136



DTC 33—Compressor Motor Control (CMC) Pulse Width Modulated (PWM) Signal Out Of Range, 138

DTC 34—Run/Lock Shift Assembly (RSA) Serial Data Lost While In Run Mode, 140

DTC 37—Accessory Power Module (APM) 12 Volt Out Of Range Major, 144

DTC 38—Accessory Power Module (APM) Low Auxiliary Battery, 146

DTC 39—Accessory Power Module (APM) 12 Volt Out Of Range Minor, 148

DTC 40—Electro-Hydraulic Power Steering (EHPS) Pump Motor Case Voltage High, 150

DTC 41—Accessory Power Module (APM) 47 Volt Isolation, 152

DTC 42—Accessory Power Module (APM) 47 Volt Out Of Range, 154

DTC 43—Automatic Disconnect Open, 156

DTC 44—Pack Voltage Fault, 158

DTC 45—HTCM Memory Failure, 160

DTC 46—Accessory Power Module (APM) Overtemperature, 162

DTC 47—Coolant Overtemperature, 164

DTC 48—Drive Motor Overtemperature, 166

DTC 49—Power Inverter Module Overtemperature, 168

DTC 50—Coolant Pump Failure, 170

DTC 51—Coolant Temperature Heat Pump Override, 172

DTC 52—Low Side Pressure Threshold Exceeded, 174

DTC 53—High Side Pressure Threshold Exceeded, 176

DTC 54—Low Coolant Level, 178

DTC 58—Coolant Recovery Check Valve (CRV) Feedback Short, 180

DTC 59—Coolant Valve Feedback Out Of Range, 182

DTC 60—Coolant Recovery Check Valve Not Responding, 184

DTC 61—47V/Compressor Motor Control (CMC) Status Line 2 Fault, 186

DTC 62—Charger Receptacle Coolant Valve (CRCV) Feedback Short, 188

DTC 63—Charger Receptacle Coolant Valve (CRCV) Feedback Out Of Range, 190

DTC 64—Charger Receptacle Coolant Valve (CRCV) Not Responding, 192

DTC 65—Brake Loadshed Occurred, 194

DTC AA—Cooling Fan Inoperative, 85

DTC BB—Cooling Fan Stays On, 86

E

Enabling the SIR System, 20

English—Metric Conversions, 25

EV1 Cabin Heating/Cooling Power Operation Matrix, 54

EV1 Service Manual Comment Form, 365

G

General Description, 83

Compressor, 288

Water Pump Assembly, 83

General System Condition

High Side Restrictions, 75

Low Refrigerant Charge, 73

Low Side Restrictions, 74

Glossary of Acronyms, 11

H

Heat Pump System R—134a Recovery, 254

A/C Accumulator Tube Assembly, 258

Installation, 260

Reversing Valve to Accumulator, 258

Removal, 258

A/C Condenser Tube Assembly, 264, 267

Reversing Valve to Condenser, 264

Installation, 265

Removal, 264

Reversing Valve to Evaporator, 267

Installation, 268

Removal, 267

A/C Evaporator Tube Assembly, 262

Orifice to Evaporator, 262

Reversing Valve to Accumulator

Installation, 262

Removal, 262

A/C Refrigerant Orifice Tube Assembly, 270

Condenser to Orifice Tube, 270

Installation, 271

Removal, 270

Charging the Heat Pump System, 255

Compressor, 285

Installation, 285

Compressor Information

Accumulator To Compressor, 280

Compressor, 280

Removal, 280

Compressor Oil Measurement, 283

Compressor Suction Tube Assembly, 273

Accumulator To Compressor, 273

Installation, 274

Removal, 273

Evacuating the System, 254

Handling Refrigerant Lines and Fittings, 256

Judgement On Contamination Of

Compressor Oil, 284

New Compressor Installed Oil Charge, 284
 O-Rings, 257
 Refrigerant Reversing Valve Tube Assembly (Discharge Tube), 277
 Accumulator To Compressor
 Installation, 278
 Removal, 277
 Reversing Valve To Compressor, 277
 Service Gauge Port Valves, 258
 Valve Core, 258
 Installation, 258
 Removal, 258
 Heat Pump Ventilation System, Heat Pump Ventilation Thermal Control System, System Operation, 49
 Heat Pump Ventilation System Introduction, 48
 Climate Control System, 48
 Cooling Mode, 48
 Heating Mode, 48
 Heat Pump Ventilation System Thermal Control Module, 219
 Heat Pump Ventilation System/Thermal Control Module, 217
 Heat Pump Ventilation System/Thermal Control Module (HTCM), 290
 Installation, 290
 Removal, 290
 Heated Windshield (HWS) Control, 80
 Heater and A/C and Blower Module, General Description, 360
 Heater and A/C Evaporator and Blower Module, 337
 Installation, 349
 Removal, 337
 Heater and A/C Refrigerant Reversing Valve Assembly, 302
 Installation, 303
 Removal, 302
 High Note Horn, 220
 High Pressure Sensor, 220
 High Voltage Disable, 16
 Removal, 16
 High Voltage Enable, 17
 Installation, 17
 Hoisting/Lifting For a Two Post Above Ground Hoist - (Side Car), 30
 Hoisting/Lifting For a Two Post Inground Hoist - (Front and Rear), 32
 HTCM General Description, 78
 HTCM Scan Tool Information, General Information, 57, 58
 HVAC Introduction, 21
 Complaint-Condition Tables, 21

General and Specific System Condition Charts, 21
 Performance Test at 45 MPH (72 KMH), 21
 Preliminary Checks, 21
 Vehicle Set Up/Performance Test, 21
 HVAC Introduction, Diagnostic Flow Chart, 21
 HWS and Compressor Status Lines, 81

I

Inside Air Temperature Sensor Assembly, 320
 Installation, 328
 Removal, 320
 Inside Rearview Mirror, 221
 Instrument Panel Cluster, 223

L

Leak Testing, 250
 Accessory A/C and D/C Power Module (APM), 249
 Installation, 249
 Removal, 249
 Adding Oil, 252
 Electronic Leak Testers, 251
 Handling R-134A, 252
 Liquid Leak Detectors, 250
 Maintaining Chemical Stability in the Refrigeration System, 252
 Oil Distribution, 252
 Recovering, Evacuating, and Charging the Heat Pump System, 253
 Refrigerant Oil Loss Due to a Large Leak, 252
 Left Hand Junction Block - J1, 225
 Left Hand Junction Block - J12, 232
 Left Hand Junction Block - J2, 227
 Left Hand Junction Block - J6, 229
 Left Hand Junction Block - J9, 231
 Lifting With a Floor Jack, 33
 Lifting, Jacking, and Support Points, 28
 Load Shed Command, 82
 Low Note Horn, 233
 Low Pressure Sensor, 233

M

Mode Valve Actuator, 234
 Mode Valve Actuator Assembly, 314
 General Description, 315
 Installation, 314
 Removal, 314
 Motor Winding Temperature Sensor, 234



N

- Normal System Performance High Humidity, High Humidity, 72
- Normal System Performance Service Stall, 71

O

- On Vehicle Service, 19
 - Service Precautions, 19
- Outside Air Temperature Sensor Assembly, 289
 - Installation, 289
 - Removal, 289
- Outside Air Valve Actuator, 235
- Outside Air Valve Actuator Assembly, 316
 - General Description, 317
 - Installation, 316
 - Removal, 316
- Outside Temperature Sensor, 235

P

- Park Brake Switch, 236
- Park Pressure Switch, 12064766, 236
- Periodic Wake-Up, 56
- Power Distribution, 56
 - System Operation, 56
- Power Electronics Bay (PEB), 39
 - Installation, 43
 - Removal, 39
- Power Steering System Test Procedure
 - Performance Test – With PDT or Service Stall, 68
 - Test 1 – Heat Pump Compressor Insulation/Megger Test, 60
 - Test 2 – Heat Pump Compressor Electrical Test, 63
 - Vehicle Set-Up, 68
- Preliminary Checks, 59
 - Installing Manifold Gauge Set, 69

R

- Refrigerant Temperature Sensor, 237
- Reversing Valve, 237
- Reversing Valve Assembly, General Description, 305
- Right Hand Junction Block – J1, 239
- Right Hand Junction Block – J12, 247
- Right Hand Junction Block – J2, 241
- Right Hand Junction Block – J5, 242
- Right Hand Junction Block – J6, 243
- Right Hand Junction Block – J9, 245
- Run1/Run2 Circuit Operation, 56

S

- Service, Diagnostic Flow Chart, 55
- SIR System, 19
- System Condition Charts, Definition and Usage, 70

V

- Vehicle "Wake-Up Command" and "Run 1/Wake-Up" During Charging, 56





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Service Manual Contents

- Heat Pump Ventilation/Thermal Control Module
- Diagnostic Charts
- General Information
- Air Conditioning
- Heating
- Ventilation

NOTE: Refer to the Index in the back of this manual or the Table of Contents in the front of this manual for location of specific component.

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